Cement MILL EDITION of Concrete

Devoted to the Manufacture,
and Use, of Portland Cement

MARCH, 1935

400 West Madison Street
Chicago, Illinois

MAR – [illegible] 1935
FOR INFO
FOR REPLY

This Program Will Go Ahead

◆

THE delay in the adoption of the President's work relief program, due to the action of the Senate, will not prevent the eventual acceptance of the program.

¶ The consequent delay in starting the large-scale housing activities contemplated under this plan will, therefore, not prevent the vigorous prosecution of this part of the program when the work relief measure is finally enacted into law.

¶ Obstructions here and there will matter little in the long run, for the nation is committed to the idea of providing decent housing for the low-income groups.

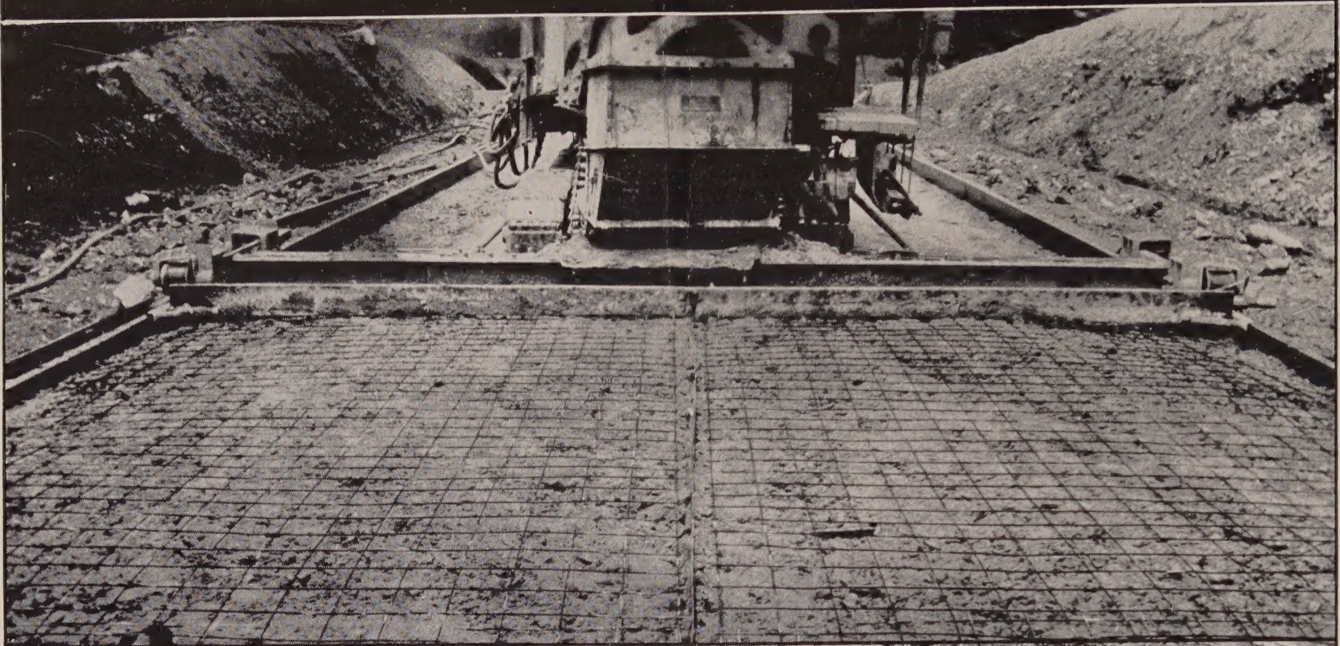
¶ This means slum clearance in large cities, subsistence homestead projects in rural and semi-rural sections, and additional housing projects similar to those in the TVA.

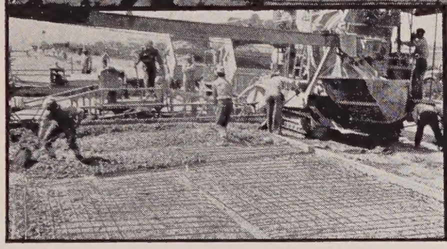
¶ There is also the great volume of other construction work planned in this measure.

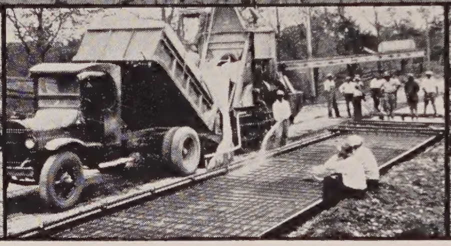
¶ Finally, there is the regular public buildings program of the federal government, for which the sum of $300,000,000 is to be appropriated.

¶ Certain it is that the federal government will provide much work for the construction industry in 1935.

POSITIVE CRACK CONTROL



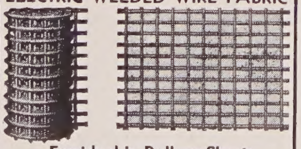




MEANS A BALANCED DESIGN

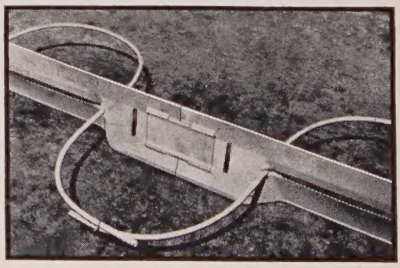
AND is provided only thru the use of reinforcing steel and adequate expansion and contraction joints. **American Steel & Wire Company Welded Wire Fabric Reinforcement** holds together the faces of the cracks that may form in a pavement slab and provides load transfer across these unpredetermined planes of weakness. A balanced pavement design increases the life of the pavement, reduces maintenance cost and permits the slab to carry designed loads without progressive deterioration. Our handbook on Reinforced Roads & Streets will be sent to you upon request.

ELECTRIC WELDED WIRE FABRIC



Furnished in Rolls or Sheets

SMITH
METAL LACED JOINT
FOR CONCRETE ROADS



This new longitudinal joint for concrete roads serves the purpose of separating the pavement in definite slabs or lanes, which, at the same time, are interlocked and laced together. We are national distributors for the Smith Metal Laced Joint and shall be glad to send you a descriptive bulletin upon request.

AMERICAN STEEL & WIRE COMPANY
208 SOUTH LA SALLE STREET • • CHICAGO
Offices in All Principal Cities

United States Steel Corporation Subsidiary

Cement Mill Edition of CONCRETE, March, 1935. Vol. 43, No. 3. $4.00 per year, 50c per copy. Entered as second-class matter, August 14, 1925, at the postoffice at Chicago, Ill., under act of March 3, 1879. Published monthly by Concrete Publishing Company, Chicago, Ill.

Vol. XLIII, No. 3 Concrete March, 1935

Notable Men of Concrete Industry Attend A. C. I. Sessions

Vibrated Concrete, Low-Cost Housing, Special Cements and Higher Structural Design Are Among Subjects Discussed — Meeting Draws Large Registration

LARGE audiences that included some of the most notable men of the concrete industry listened to the speakers at the thirty-first annual convention of the American Concrete Institute, held at the Roosevelt Hotel in New York on February 19, 20 and 21. The convention drew a total registration of 523.

A departure from former annual meetings of this organization was seen in the manufacturers' exhibit of high-frequency vibrating equipment—an exhibit probably suggested by the fact that high-frequency vibration occupied an important place in the convention program. While the exhibit was small, and impromptu in character, some convention visitors suggested that organized exhibits of much larger scope might serve as lively stimulants of interest at future annual meetings.

Talks on Special Cements

Cement, the basic ingredient of concrete, occupied the entire time of the first session—and the various special types of cement claimed the greater part of this period. Notable among these papers was that by Prof. Raymond E. Davis, J. W. Kelly, G. E. Troxell and H. E. Davis, all of the University of California, on mortars and concretes containing portland-puzzolan cements. A year ago Prof. Davis and his associates presented a paper on blended cements, and their more recent contribution may be regarded as a progress report on this subject. This paper contains a report on 17 blending materials, 6 portland cements and 82 blended cements, with particular reference to properties such as grindability of cement, tensile and compressive strengths, heat of hardening, volume change, and resistance to suphate waters.

High-Early-Strength Cements

Trends in the production and use of various types of hydraulic cements were discussed by P. H. Bates, chief of the clay and silicate products division of the National Bureau of Standards, who pointed out that the demands of service conditions must be met by cement manufacturers.

Prof. Inge Lyse, of Lehigh University, presented a paper on the performance record shown by 13 brands of standard portland cement and 5 high-early-strength cements, with reference to strength and durability of the resulting concrete. Benjamin Wilk, general manager of the Standard Building Products Co., of Detroit, offered a paper of high practical value, outlining the numerous ways in which manufacturers of high-grade concrete building units and other concrete products can make advantageous use of high-early-strength cement.

The Concrete Home

The second session of the meeting was devoted wholly to the use of concrete and concrete units in home building. The papers presented show conclusively that the low-cost concrete house is an accomplished fact. This point was emphasized in particular in the talks and lantern slides offered by R. R. Zipprodt and W. G. Kaiser, both of the Portland Cement Association. Through the use of concrete ashlar units and ordinary concrete masonry, as well as larger precast wall units, coupled with precast concrete joist-and-slab floors, fireproof homes that are attractive from the architectural standpoint can now be built at low cost.

John J. Earley, architectural sculptor, Washington, D. C., described and illustrated a small house built by his organization near Washington, in which the exterior consists of precast decorative concrete slabs. Full information on the method of casting these slabs, and the construction methods and details employed, are given in an illustrated article on page 21 of the December (1934) issue of CONCRETE.

Tests to determine the strength of monolithic concrete walls were described by R. E. Copeland, of the Portland Cement Association, in a paper written jointly with N. M. Newmark, of the University of Illinois.

Structural Design

Higher problems of structural design were discussed during the third session, in three notable papers presented by Hardy Cross, professor of structural engineering, University of Illinois; by R. L. Bertin, chief engineer, White Construction Co., New York; and by Ben Moreell, Lieut. Commander, civil engineer corps, U. S. Navy.

Prof. Cross discussed the continuous frame and the need for simplicity in methods and formulas in analysis. Mr. Bertin described the construction of a hemi-spherical dome for the Hayden Planetarium, the dome consisting of a reinforced concrete shell from 3 to 3½ in. thick over a span of 80 ft. 6 in. Lieut. Commander Moreell described and illustrated a number of practical uses of the Mesnager hinge in arched structures of reinforced concrete.

Vibrated Concrete

High-frequency vibration of concrete during placing occupied the time of the fourth session. This subject was handled as a report of Committee 609, of which the chairman is Alfred E. Lindau, consulting engineer, Chicago. Certain phases of the problem of vibration had been assigned to various members of the committee, and their answers were presented in a series of short reports. These included studies of freezing and thawing, permeability and strength of vibrated concrete of low cement content, by Prof. M. O. Withey, of the University of Wisconsin. Vibrated concrete in pavement slabs was the subject reported by F. V. Reagel, engineer of materials, Missouri State Highway Department. Another angle of high-frequency vibration in the construction of concrete pavements was discussed in a report by F. H. Jackson, senior engineer of tests, U. S. Bureau of Public Roads. Various problems of vibration encountered in the construction of dams, bridges and buildings were discussed in other reports prepared by Lewis H. Tuthill, testing engineer, Metropolitan Water District of Southern California; by Sam Comess, assistant engineer, Rock Island District, U. S. Engineers; by C. M. Hathaway, engineer of construction, Illinois Division of Highways; by W. R. Johnson, concrete inspector, Tennessee Valley Authority; and by T. E. Stanton, materials and research engineer, California State Highway Department.

Problems of Concrete-Making

Various problems involved in the making and placing of concrete were discussed during the final session, including a paper on concrete in factory construction, by L. F. Fairchild, structural engineer for the Eastman Kodak Co. Architectural considerations in concrete bridge design was the subject of a paper by Morris Goodkind, bridge engineer, New Jersey State Highway Department. T. E. Stanton, materials and research engineer, California State Highway Department, discussed the solving of concrete placing problems. A. Burton Cohen, consulting engineer, New York, and R. B. Young, testing engineer, Ontario Hydro-Electric Power Commission, presented a joint paper on the need for the employment of high-grade inspectors on concrete construction work. R. F. Blanks and C. C. McNamara prepared an excellent paper on mass-concrete tests in large cylinders, the paper having been presented by Roy W. Carlson, assistant professor of civil engineering, Massachusetts Institute of Technology.

Medals and Officers

The speaker at the annual banquet was Edward J. Mehren, who discussed "Concrete—Yesterday, Today and Tomorrow." The Wason medal for the most meritorious paper in the last *Proceedings* (Vol. 30) was presented to Raymond E. Davis, Roy W. Carlson, G. E. Troxell and J. W. Kelly, for their joint paper on investigations of cement for Boulder Dam. A. G. Timms and N. H. Withey were awarded the Wason medal for research, for their paper on temperature effects on the compressive strength of concrete.

P. H. Bates, who filled out the unfinished term of Arthur R. Lord as president of the Institute, was elected president for the coming year. F. R. McMillan and J. C. Pearson were elected vice-presidents. New district directors are E. Viens, A. W. Stephens, Clyde T. Morris, Ben Moreell, F. E. Richart and C. H. Scholer. Raymond E. Davis is director-at-large. The next annual convention is to be held in Chicago.

Lessons from the Indian Earthquake

THE following conclusions, drawn after examination of the effects of the destructive earthquake in Bihar on January 15, 1934, are in marked agreement with lessons learned from other major earth shocks in various part of the world.

(1) A building should be as far as possible one monolithic unit.

(2) Arches must be avoided at all costs. These invariably collapsed in recent earthquakes in Bihar.

(3) Existing heavy roofs must have their supports strengthened.

(4) Foundations should be as continuous as possible.

(5) In vertical planes the frame should have diagonal bracings so as to give resistance to lateral forces, and horizontally the floor should be a rigid monolithic unit so as to transmit the stresses evenly to the different vertical frames.

(6) In designing members the combined stresses due to ordinary load and earthquake forces should be taken into account and the sum of these must not exceed the ordinary allowable stress of structural materials.

(7) Wall columns should, where possible, form exterior wall frames and be rigid and strong enough to take their share of earthquake forces parallel to the walls.

(8) Diagonal arrangement of wall reinforcement is the most effective type.

(9) Mortar, where used, should be made of cement and not lime.

(10) It has been the experience of builders in all earthquakes that reinforced concrete has withstood shocks better than any other material. It resists fire which so often accompanies an earthquake and lends itself most readily to the latest and most scientific designs.—From special issue of "The Indian Concrete Journal," October, 1934.

Cost of Drilling Holes for Raising Settled Road Slabs

Missouri State Highway Department Develops New Rotary Drill—Eliminates Spalling

By C. P. OWENS
Maintenance Engineer, Missouri State Highway Department, Jefferson City, Missouri

A FEW years ago the mud-pump or mud-jack system was developed for raising settled slabs. It has been common practice to use compressed air jack hammers to drill the necessary 2½-in. holes. Where holes were drilled with jack hammers, serious spalling occurred around the holes on the bottom side of slabs. Investigation too often revealed these craters to be 12 to 18 in. in diameter and from 2 to 3½ in. in depth. Since three rows of holes spaced about 6 ft. center to center are usually drilled, this spalling seriously weakens the pavement.

After some preliminary experimentation the bureau of maintenance of the Missouri State Highway Commission sketched designs for a portable rotary shot drill and placed orders for their manufacture. The design provided for slow-motion power drive to facilitate shifting or movement of the drill from hole to hole, particularly on grades. The drills are also equipped with brakes and steering levers. The steering levers, brake lever and drive controls are located conveniently near the drill head controls. For long moves the machines are loaded on specially equipped trucks. Two drills and a truck made up a working unit.

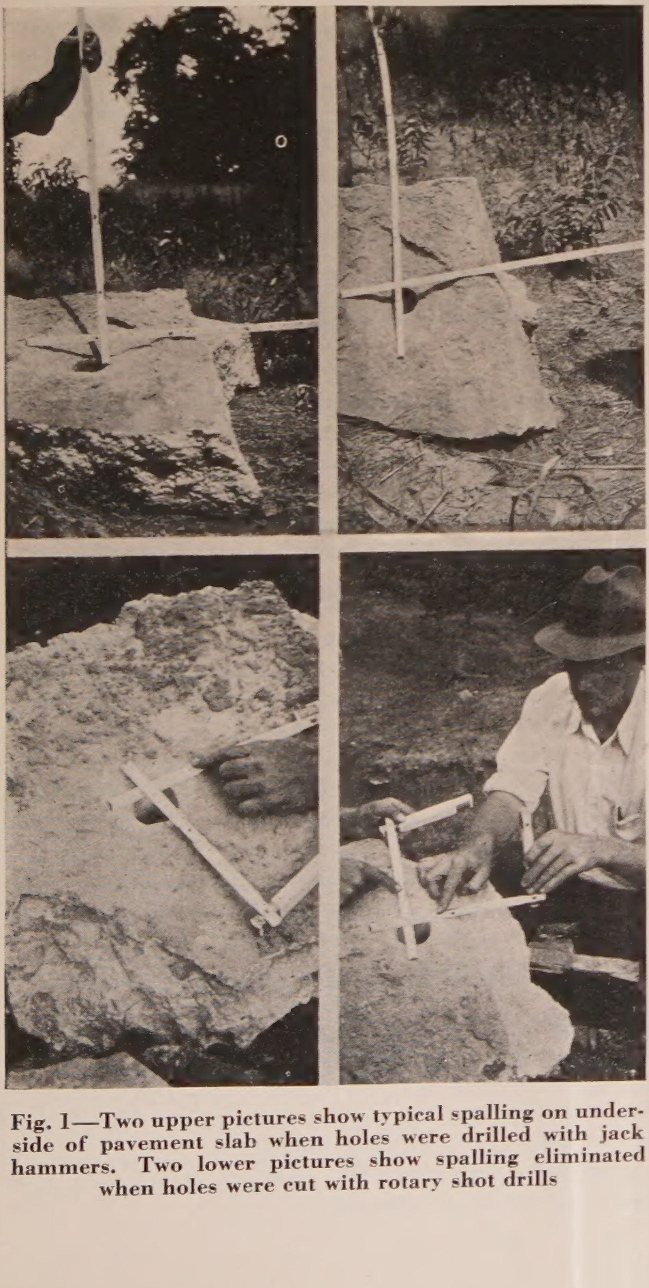


Fig. 1—Two upper pictures show typical spalling on underside of pavement slab when holes were drilled with jack hammers. Two lower pictures show spalling eliminated when holes were cut with rotary shot drills

Rotary Drill Eliminates Spalling

In the illustration shown as Figure 1 the two upper pictures show typical conditions encountered where concrete made with gravel aggregate had been drilled with jack hammers. Concrete having Bethany Falls limestone as the coarse aggregate spalled in a similar manner. Gravel aggregate concrete invariably spalled to a greater extent than limestone aggregate concrete, but the condition was serious in either case.

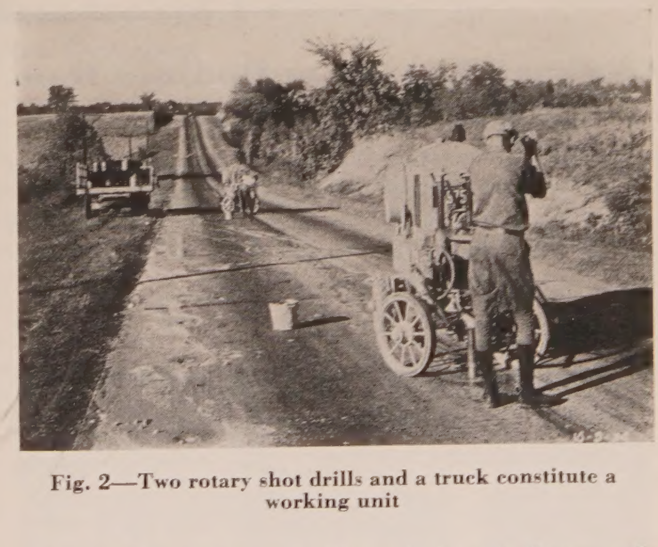


Fig. 2—Two rotary shot drills and a truck constitute a working unit

The two lower pictures in Figure 1 show the bottom side of pavement concrete drilled with rotary shot drills with the entire weight of the drill on the bit until the hole was finished. As our practice developed, however, we learned that the operator should ease up on the pressure on the bit as the drilling of a hole nears completion. In fact, we learned that the rotary shot drill cuts faster when the use of maximum pressure is avoided.

The holes cut with these rotary drills are straight, round and smooth, and spalling around the bottom of the hole is eliminated.

Cost Data

Absolutely accurate costs on drilling holes with jack hammers are not available; but several test runs with the jack hammer drills indicated that costs would average about 20 cents per hole. The accompanying tabulation of costs of operating rotary drills is compiled from daily field reports and pay rolls and covers a period of 5 months of continuous operation. The items of cost included are:

1—Salary and expenses of field foremen.
2—Labor.
3—Truck rental; operation 5c + depreciation, 6c, or a total of 11c per mile.
4—Core drill rental; operation 55c + depreciation 30c, or a total of 85c per hour.

Operation costs include fuel, oil, repairs, tires, grease, parts; and, in case of core drills they include also steel shot, bits and tools.

Depreciation rates contemplate retirement of the purchase price during the life of the equipment. Interest, insurance and taxes are not included. Supervision and overhead are not included in cost data.

The average cost of drilling 58,681 holes is 37.7c each. The average for types of concrete range from $1.12 each for holes in reinforced concrete made with hard gravel aggregate to 25.8c each for holes in plain concrete made with limestone aggregate. The depth of holes varied from 6 to 7 in. to 9 in. along the thickened edges.

Conclusions

Since it is common practice to drill a line of holes along each edge of pavement and one along the center, spacing holes 6 ft., a hole is drilled for each four square yards of pavement raised by the mud-jack. When the cost of jack hammer drilling is 20 cents per hole, the cost per square yard is 5 cents. When the cost of drilling with the rotary drill is 40 cents per hole, the cost per square yard is 10 cents. This added cost is a small portion of the total cost of raising slabs with mud-jacks, especially when the benefits of obtaining true, round and straight holes without spalling the bottom of the slabs are given due consideration.

MISSOURI STATE HIGHWAY DEPARTMENT—BUREAU OF MAINTENANCE
Cost of Drilling Holes in Concrete Pavements with
Portable Rotary Shot Drills

By Divisions—All Types of Aggregate

Division	Hours Worked	Holes Drilled	Cost Total	Cost Per Hour	Cost Per Hole	Minutes Per Drill Per Hole
No. 1	634.5	11,613	$2,925.52	$4.61	25.1c	6.5
No. 2	336.5	3,382	1,346.34	4.00	39.8	12.0
No. 3	607.5	3,889	2,457.62	4.04	63.1	18.7
No. 4	1,431.5	23,008	5,591.18	3.90	24.3	7.5
No. 5	407.5	6,008	1,767.65	4.33	29.4	8.2
No. 6	912.5	4,214	4,441.61	4.86	105.0	26.0
No. 10	752.5	6,567	3,640.14	4.83	55.4	13.6
Total	5,082.5	58,681	$22,170.06	$4.36	37.7	10.3

By Types of Aggregate—All Divisions

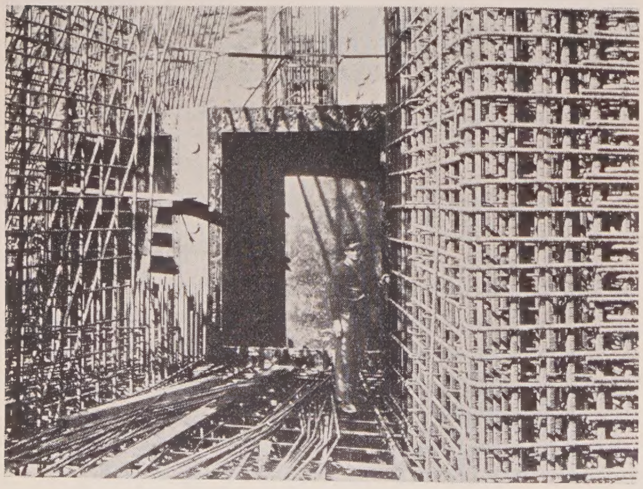
Type of Aggregate	Hours Worked	Holes Drilled	Cost Total	Cost Per Hole	Minutes Per Drill Per Hole
Gravel—Plain	1,630.5	11,315	$7,296.35	64.8c	17.1
Gravel—Reinforced	540.5	2,261	2,535.93	112.0	28.5
Limestone—Plain	2,513.5	40,982	10,582.32	25.8	7.3
Limestone—Reinforced	398.0	4,123	1,727.87	41.9	11.5

NOTE: Above costs are for drilling 2½-in. diameter holes.

Concrete Towers at Boulder Dam Heavily Reinforced

IN line with the "bigness" of almost everything connected with Boulder Dam, the illustration here presented shows one of the recently installed intake gates and the heavy steel reinforcement of one of the four reinforced concrete intake towers at the dam.

The concrete towers are 342 ft. high and 32 ft. in inside diameter. Each tower contains two welded steel cylinder gates. The eight gates installed, together with the nose liner assemblies, contain 1,550 tons of steel. The quantity of concrete reinforcement placed in the four towers amounted to 7,350 tons, equivalent to 158 lb. of steel to the cubic yard of concrete.



Heavy steel reinforcement indicates massiveness of concrete intake towers at Boulder Dam

Wisconsin C. P. A. Convention

THE Wisconsin Concrete Products Association, Inc., will hold its thirteenth annual convention at the Pfister Hotel in Milwaukee on March 21 and 22, the same week as the Home Show in Milwaukee.

A program of vital interest to all manufacturers of concrete products is being planned.

The annual business meeting will be held at the same time and new directors chosen for the coming year.

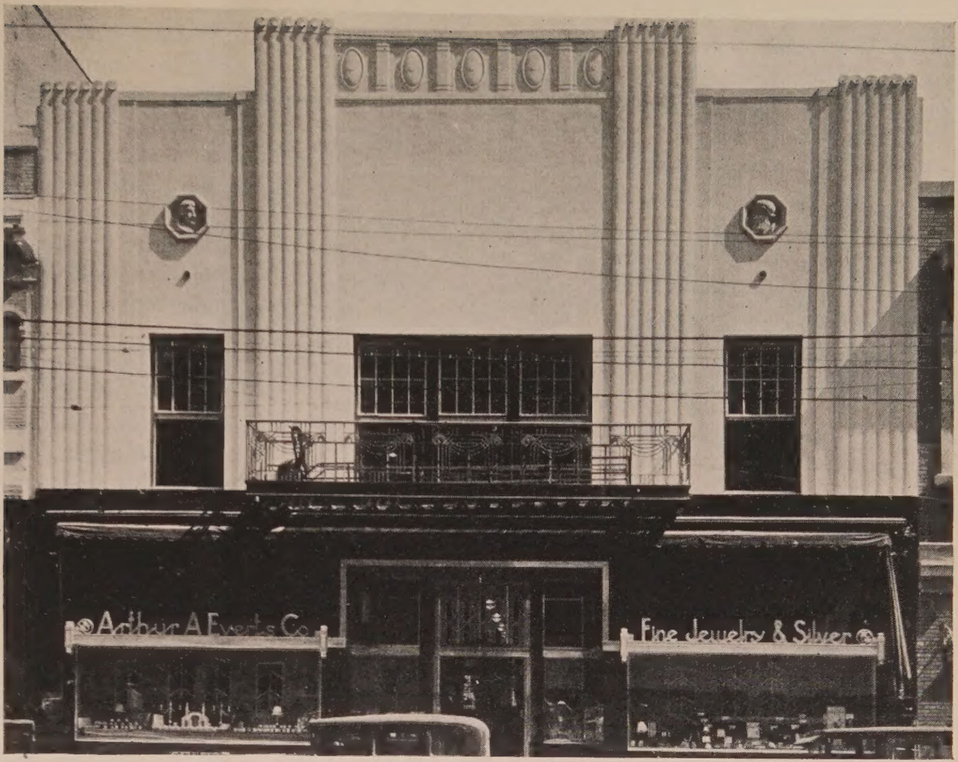
L. E. Schwalbe of the Economy Concrete Products Co., 6332 W. State Street, Wauwatosa, Wisconsin, is secretary.

Building Exposition

UNDER the auspices of the San Francisco Builders Exchange, San Francisco is announcing an annual building exposition and convention to be held at the Civic Auditorium, May 4 to 12—an exposition of the products and services of the building industry.

Frederick Weddleton, 644 Mission Street, San Francisco, California, is manager.

Coating of dense reinforced concrete, applied under air pressure, modernized this old brick store front in Dallas, Texas



New Vacumite Process Modernizes Retail Jewelry Store

Coating of Dense Concrete, Shot Under Air Pressure, Bound to Old Brick Wall—Speed, Economy and Architectural Appearance Are Features

FACE-LIFTING of store fronts got the jump on almost every other kind of modernizing activity, and it has proceeded so rapidly that merchants now consider it a matter of self defense. The psychology is elementary. Given a row of establishments purveying the same group of commodities at the same price level, the customer will choose the one where beauty and charm will ease the pain of parting with dollars. A good front may be only the smile showing through bitter tears, but it has the appearance of opulence which is a kind of warmth people like to bask in, in the spirit of old times.

Covers and Strengthens Old Building

Among the scores of ingenious ways of "doing over" store fronts is one which not only hides the old hole-in-the-wall appearance, but permanently strengthens the old structure. At the same time, it assumes an inconspicuous place in the budget. This new method is called Vacumite, a process of applying dense concrete under pressure over old surfaces. In one operation it achieves both structural and architectural advantages for the cost of one.

The case in point is the Arthur A. Everts Company building in Dallas, Texas. Early in 1933 the front of this large jewelry shop was so obsolete and unsightly that the owners seriously contemplated tearing the whole building down and starting all over. The chief hitch in this program was the pall of economy and retrenchment which hovered over the scene as thickly as it had everywhere else in the country. There was, further, some reluctance to destroy a building which, with a little bolstering and rearrangement, might have many useful years ahead of it.

Careful Architectural Treatment

A remodeling program was decided upon and the front of the building naturally became one of the principal concerns. Above everything else, it would reflect the fact that the store was entering the modern era. The architects, Greene, LaRoche and Dahl, designed a modern front to be applied over the old rough brick surface. The motif was four fluted columns which had no counterparts on the old front and would, therefore, have to be built up. The design also called for flat wall surfaces, the same kind and color of material as the columns, covering approximately 700 sq. ft. of the old wall. Several factors determined the choice of the material and method of building this new front.

First, it was felt that it would be impractical and too costly to build the front of hand-placed stucco or stone; second, the improvement would have to provide reinforcing for the old wall to make it structurally sound; and finally, the work would have to start immediately and be concluded in minimum time. The Vacumite process was approved because it would provide a reinforced concrete encasement firmly bonded to the old wall, on which the new architectural features could be formed in the plastic stage and, when hardened, give the additional strength needed for the wall.

The work was started four hours after the contract was signed, on February 2, 1933, and completed on February 17. Weather during the construction period was inclement, with freezing temperatures, rain and sleet occurring during part of several days. A 5-man crew was all that was required to do the job. Equipment consisted of one 110 cu. ft. air compressor, one Vacumite open feed hopper, one 5-ft. mixing hopper, one 30-gal. water tank, 20 ft. of 1½-in. suction feed hose, 100 ft. of 1-in. air hose and ½-in. air hose, and one 1-in. flare tip nozzle.

The Construction Procedure

Following is the procedure for placing concrete by the Vacumite process:

The old wall was thoroughly cleaned of dirt, grease and loose matter that might prevent complete bonding. Steel reinforcement was then set in place, anchored firmly to the wall. Cement and sand were thoroughly mixed and the mixture was transferred to the feed hopper. With air pressure and water controlled at the nozzle, the mixture was forced up through the suction feed hose and applied uniformly in increment layers over the areas to be covered. The finishers then formed the desired surface features and texture with hand tools.

On the Everts building the fluted columns were formed by placing two outside straight-edge screeds—since the old brick wall base was rough and untrue in line—and then building up with a dense mixture. A forming tool with a steel cutting edge was used to shape the flutes. It was not necessary to make construction joints, for the process insured a bond to the masonry and to the work done the previous day, leaving no signs of joining between new and old work.

The base course used one sack of cement to 3.22 parts of sand (by volume) in place, while the finishing course used 2.76 parts of fine sand to one part cement. Clean, sound, well graded silica sand was used. It was graded down from that passing a No. 4 sieve for the base course, and sizes graded from No. 8 down were used in the finish coat. Since the water needed for hydration was controlled in the nozzle, the amount of water used varied from 2.9 to 3.2 gal. to each sack of cement. This low water-cement ratio assured a dense mixture which is impervious and durable.

It was found that freezing temperatures of 20 deg. F. within six hours after placement by this process did not affect the work. High-pressure placement, density of mixture and low water content are regarded as the protective factors in this instance. The change in volume during and after hydration was very small and, therefore, no effect of flaking or checking was evident.

Find No Flaw in Workmanship

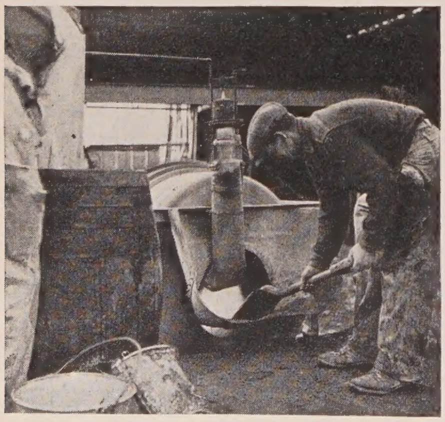
Frequent observation during the two years since the job was finished has failed to reveal any failure in the encasement. The color has remained uniform throughout, and the whole front looks as neat and trim as the day it was completed, cured and turned over to the owners in fulfillment of the contract.

The advantages in appearance, permanence, ease of application and economy through this method of resurfacing old structures makes it available and desirable for use in modernizing thousands of buildings which need only a modern, protective exterior coating to give them new value and increased years of service.

Acknowledgments: The Watson Company, of Dallas, were the general contractors on this remodeling work. The subcontractor who applied the reinforced concrete front here described was F. G. Mannan & Sons. The Vacumite process was developed by the Vacumite Bonded Cement Process, with offices in the Interurban Building, Dallas, and in the Post-Dispatch Building, in Houston.

Mixer Heating Torches in Winter Concreting

THE illustration here presented shows the use of an oil-fired mixer heating torch employed in the direct heating of concrete within the mixer.



Oil - fired heating torches for use with concrete mixers are on the market

On one construction project described in *Winter Construction Methods,* by Charles S. Hill, a ¾-yd. mixer was fitted with two kerosene torches placed side by side in the charging opening. The mixer rotated at the rate of 17 r.p.m. A 20-gallon supply tank fed the torches, which consumed about 3 gallons each per hour. Air pressure on the torches was quite irregular, ranging from 30 to 75 lb. This variation caused trouble by putting out the flames; and the wind also extinguished the flames at times. The most satisfactory pressure was found to be 30 lb.

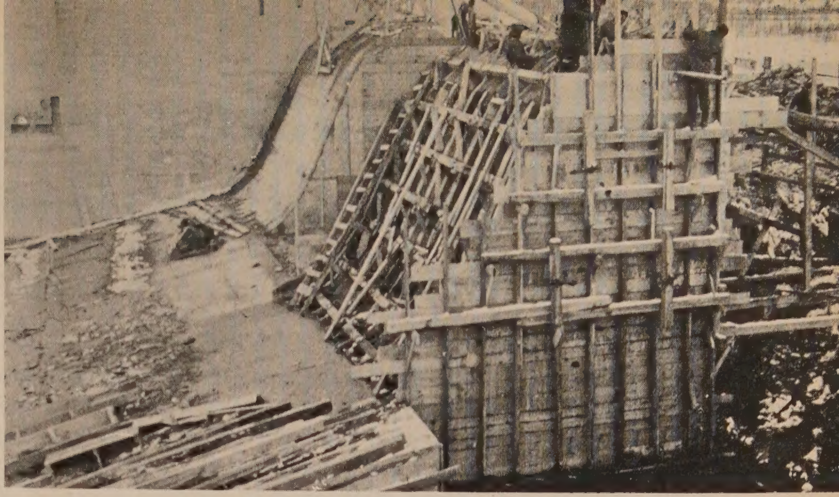
Care must be taken in lighting these torches. Lighting them by hand is a dangerous practice, and should not be permitted. On the construction project just mentioned, the torches were lighted by means of a gas-range igniter attached to an acetylene gas tank.

During the actual mixing operation the sand, cement and water were put into the mixer and turned a few times, then the stone was added. The torches were then turned on full for 1½ to 2½ minutes. This generally produced a temperature of 70 to 80 deg. F. in the mixture. Each additional half minute raised the temperature of the concrete by about 22 deg. F.

Great Volume of Concrete Work in Conservation Program

State of Ohio Takes Measures to Restore Level of Ground Water—How Conservancy Districts Operate

By A. F. UNCKRICH
Conservation Engineer, Columbus, Ohio



Twenty drained lakes in Iowa are being refilled by concrete dams such as this o
at Backbone State Park. This dam was built by the CCC

IN the last issue of CONCRETE the writer described how the cutting away of forests, the draining of lakes, swamps and streams, the tiling of farm lands, and various other human activities, have lowered the groundwater level, reduced evaporation and, in consequence, reduced rainfall. Measures taken in and by the state of Ohio to correct this dangerous situation will now be described in some detail.

Conservation Congress Organized

On June 7, 1933, the Ohio Valley Conservation and Flood Control Congress was organized. The objects of this Congress were to publicize and present to the proper authorities the need for adequate measures of conservation and flood control for the Ohio Valley. This Congress is now sponsoring a program which contemplates 9 proposed conservancy districts, a $211,000,000 construction program and 39 reservoirs or their equivalent as the plan for ultimate development. This parent organization has assisted materially in the formation of other local flood control and water conservation associations.

Muskingum-Tuscarawas District Leads Off

Early in 1933, when the President asked for programs to put men to work, the Muskingum-Tuscarawas Improvement Association immediately circulated petitions to form a conservancy district, and on May 5 these petitions were filed, a hearing was held on May 29, and the district was formed June 2, 1933. Three directors were appointed, an engineer was employed, and preliminary plans and studies were prepared. On the basis of these plans an application was sent to Washington for a PWA appropriation to carry out the program. It involved 15 reservoirs to control and conserve the waters of the Muskingum and Tuscarawas rivers and their tributaries.

The fact that Ohio had the necessary legislation already enacted which would permit work to start immediately had a big influence toward getting a PWA grant of $22,090,000. This was the estimated cost of dam construction and relocation of 90 miles of railways. The grant was made contingent upon Ohio appropriating $12,000,000 for the purchase of land and relocation of highways and towns. The Conservancy Court, which is composed of 16 county common pleas judges, one from each county in the district, decided that $12,000,000 was more than the district could assess against the property benefited. The court did, however, agree to recommend an assessment of $6,000,000 against the valley. It was then necessary to send a committee of the district to call on the Governor of Ohio, requesting him to send a message to the legislature then in special session, asking for an appropriation of $2,000,000 from the general fund and an enabling act authorizing the State Highway Department to change all highways in any conservancy district.

Contracts Awarded

When this financing was completed, official plans were prepared by the War Department Engineers. These were approved by the board of directors of the district late in September, and the final hearing was held on November 19, 1934. It is very interesting to note that the county common pleas judges, one from each county in the district, voted unanimously to approve the plan and proceed. Contracts for the first three projects, awarded in November, will utilize 31,000 cu. yd. of concrete, even though the projects involved are earth-fill dams. The program calls for awarding two reservoirs per month, starting in December, 1934, and continuing until the 15 projects have been let. From the date of circulating the petitions to the award of the first project, 20 months have elapsed. The experience gained will result in more speedy action on future projects.

Public meetings were held in several of the counties, at which meetings the War Department engineers and the conservancy district directors and their engineer were present. At these meetings an attempt was made to explain the conservancy district to the people.

Large Volume of Construction

In the Muskingum district there will be 18,000 acres covered by permanent water, providing for 200,000 acre-feet of permanent storage. Sufficient land will be purchased to permit 1,600,000 acre-feet of emergency storage. Approximately 88,000 acres will be needed for this.

In projects of this kind the government has the right of eminent domain, which will permit construction to start immediately. The settlement for lands acquired can be made later.

It is estimated that the minimum amount of concrete required for the dams and reservoirs is 400,000 cu. yd. This does not include any highway relocation, relocation of bridges and structures, relocation of towns, nor any shore protection and revetment work, all of which will require much additional concrete work. It will be necessary to relocate 54½ miles of state highways and 118 miles of county roads at a total estimated cost of $4,000,000. It will also be necessary to relocate structures in the amount of $800,000.

The Scioto-Sandusky Conservancy District

Another example of a conservancy district now being formed in Ohio is the Scioto-Sandusky Rivers water shed. Early in October, 1933, invitations were sent to all civic organizations, city officials and prominent citizens in the Scioto and Sandusky Rivers water shed to attend a meeting to be held in Columbus on October 31, 1933, to form a conservancy district in this territory. At this meeting talks were given by the state geologist, state conservation commissioner, chief of the Ohio Soil Survey, director of zoology and entomology, chief of the bureau of scientific research, director of dairy testing, director of water conservation, the secretary of the Ohio Valley Conservation and Flood Control Congress, and other prominent citizens.

After a considerable discussion at this meeting, it was decided to form the Scioto-Sandusky Conservation Association. The plans were then made to raise $7,700, which was the estimated amount necessary to promote the district. This includes a cash bond of $1,500 which is necessary to be filed upon the presentation of the petitions. Not less than 500 signatures of free holders are necessary on a petition of this kind; but 4,000 were obtained, and on October 30, 1934, these petitions were filed with the common pleas court in Franklin county. A hearing on December 3 before the 17 county common pleas judges representing the 17 counties of the district resulted in a vote of 16 to 1 to form the district.

Construction Work Totals $34,000,000

Preliminary plans have already been made for this water shed district under act of Congress in 1929, at which time there was appropriated $5,000,000 for a survey of all the inland waterways for flood protection, water conservation, hydro-electric power and navigation. This is known as Survey Report 308 of the 69th Congress. The sum of $3,000 has been appropriated from the emergency fund of the state to make additional preliminary surveys of this district. It is expected that the financing of this project will be similar to that of the Muskingum Valley.

The extensiveness of this district is shown by the plans for the construction of 10 dams and reservoirs. Creation of the summit-level lake, 40 miles in length, will require two concrete dams. The estimated total cost is $34,000,000. No water rights will be given to any city from any of the reservoirs in this district unless they will agree to construct a disposal plant. No leases for cottages will be given unless they agree to put in a concrete septic tank.

The ancestor of all these Ohio projects is the Miami Conservancy District, which was formed in 1917, following the great flood of 1913 that caused $66,000,000 damage in the Miami Valley. This project was completed in 1922. It required 5 earth dams and reservoirs. The project cost $33,000,000 and utilized 260,000 cu. yd. of concrete in the earth dam construction alone. In addition, the town of Osborn had to be relocated at a cost of $1,000,000. All of this was a big job, but it definitely removed all danger of future floods from Dayton and the other towns and industries in the Big Miami Valley. However, this project is a purely flood control project and does not provide for any impounding of waters for water conservation.

Concrete Aids Fight Against Erosion

Thus far we have considered the large opportunities for concrete construction in the control of national water resources. A second activity is now being fostered that represents a considerable volume of work. This is the control of soil erosion to save farms. The soil erosion service is a branch of the Department of the Interior. Through this service communities are being asked to undertake programs of construction that will prevent the loss of valuable soils through erosion as well as the protection of valley lands from over-deposit of silt.

Erosion is controlled by the construction of small check dams. These dams may be built of stone, timber or concrete. Each dam requires only a small amount of concrete; but when the number to be built on a single wash is considered the construction requirements will be large.

Since the establishment of this service, 24 large federal projects have been started. This service is to be expanded and will undoubtedly prove to be the source of much concrete construction work.

Much Work on Individual Farms

Closely allied with soil erosion control is the development being fostered by county agents to have farmers build small dams to impound water for farm and livestock use. In Ohio, through the co-operation of the FERA and the Water Conservation Board, there has been sent to all county relief directors a letter stating that as a measure of water conservation and drought relief it is planned to construct small reservoirs or ponds at suitable locations throughout the state, and that this construction will provide a number of work projects. Relief directors were instructed to co-operate with the county agricultural agents in carrying out this program. Dams may be constructed upon public, semi-public, or private property. Each application for such construction on private property must be accompanied by (1) an easement from the property owner granting full and free use of the lands covered by the impounding water; (2) rights of access for all proper public authorities; and (3) waivers of liability for all damages.

Owners of property occupied by reservoirs will be expected to donate the use of teams, plows and scrapers for use on the project. It is permissible upon approval by the State Relief Commission to construct reservoirs upon privately owned lands in cases where the owner of the land does not grant an easement for public use, provided that in such cases the owner of the land furnishes all materials and equipment.

A bill has been introduced into the Ohio legislature which, if passed, will authorize the Conservation Board to buy land for reservoirs and recreational purposes.

Here is a program that offers tremendous possibilities to the concrete construction industry for dams, impounding reservoirs, sewage disposal, recreation facilities around the lakes, construction of new roadways, relocation of old roads and railways. It is an activity for the advancement of which the co-operation of powerful local groups can be obtained.

Ashlar and Low-Cost Homes Attract Concrete Masonry Convention

It is no exaggeration to say that the annual convention of the National Concrete Masonry Association, held at the Pennsylvania Hotel in New York on February 18 and 19, was the most successful annual meeting in the history of that organization.

The total registration of 85 and a program of exceptional interest combined to make this recent meeting one long to be remembered.

Low-Cost Housing

Low-cost fireproof housing came in for a large share of the papers and floor discussions at the convention. Interest in this subject was centered not alone in private construction projects, but more particularly in contemplated public works construction under the proposed new work relief program of the federal government. This national program, as is well known, is to include government-constructed projects such as subsistence homestead and slum clearance developments, and government-supported projects of private or semi-private character.

In these new governmental construction activities the concrete masonry industry expects to play a part—an expectation that is well supported by the fact that many concrete masonry houses actually appear among the subsistence homestead developments thus far completed (including TVA homes at Norris, Tenn.). Government officials look with favor on types of construction that will bring fire-safety, durability and low maintenance costs into the humble home; and these qualities they are finding in concrete masonry construction.

Code Troubles Discussed

The code troubles of the concrete masonry industry were discussed at length at one of the sessions. Much has been accomplished under the present set-up of code administration, but the general opinion seemed to favor the idea of de-centralizing the enforcement agencies. Under this arrangement a national code authority will be maintained, but the "policing" will be done by local committees. All speakers seemed agreed on the assertion that price fixing is "out." Some suggested throwing out price filing also; but the majority expressed themselves definitely in favor of retaining this feature. During these discussions the convention had the advantage of the presence of Amar Cater, deputy administrator, NRA, Washington, D. C., and of Colonel Beverly Ober, administrator of the Code, also of the NRA.

Valuable Papers Presented

A number of valuable papers and illustrated talks were presented at the two-day sessions. Benjamin Wilk, president of the association and general manager of the Standard Building Products Co., of Detroit, opened the program with an excellent "message" on the state of the industry, while at a later session he presented a paper on the economy of high-early-strength cement in the manufacture of concrete products.

C. E. Burbank, of the Bedford Hills Concrete Products Co., Bedford Hills, N. Y., offered a paper of a highly practical character on the subject of concrete floors of precast joists and slabs. Of particular interest was his description of the servicing which this company supplies to contractors and architects who are unfamiliar with this form of floor construction.

Other notable papers included one by Major Charles C. Anthony, of the industries division of the NRA, on "What the FHA Is Doing to Stimulate Your Market." D. R. Collins, of the Portland Cement Association, covered the subject of "Concrete Masonry Homes—the Answer to Long-Term Financing." L. N. Whitcraft, district engineer of the Portland Cement Association (New York office) described how an advertising campaign developed prospects for 5,000 concrete houses.

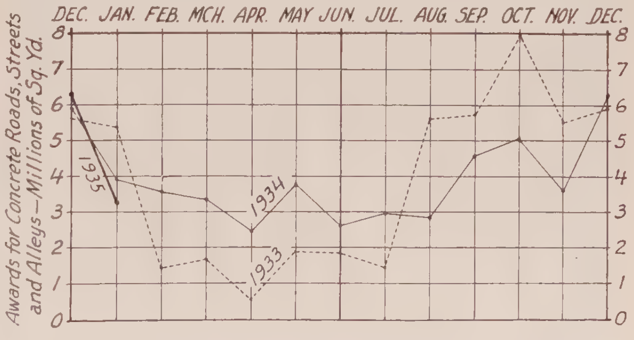
Einar Christensen discussed low-cost housing projects in the TVA, and W. G. Kaiser, manager of the cement products bureau of the Portland Cement Association, explained how concrete masonry is finding increasing importance in the fields of sound and heat insulation.

Louis Gelbman, Yonkers, N. Y., read a paper on the manufacture and sale of concrete ashlar units; and, as a matter of fact, concrete ashlar was the type of unit that was most under discussion throughout the entire meeting, not only in papers and floor discussions, but in illustrated talks.

Several of the convention papers contained matters of widespread interest to the concrete products construction industry as a whole, and will be published in forthcoming issues of CONCRETE, thanks to the courtesy of the authors.

Paving Awards Reach 45 Million Yards

CONTRACTS for concrete roads, streets and alleys awarded in 1934 reached a total of 45,107,515 sq. yd., almost identical with the total awarded in 1933.



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Concrete pavement construction contracts, expressed in sq. yd., in 1933 and 1934—

Full year of 1933	**45,128,441 sq. yd.**
Full year of 1934	**45,107,515 sq. yd.**

The accompanying chart, showing monthly contracts for the past two years, is prepared from data collected by the highways and municipal bureau of the Portland Cement Association.

Cinder Concrete Products Industry Goes After Bigger Markets

THE National Cinder Concrete Products Association held its eleventh annual convention in New York on February 14, 15 and 16. The total attendance was 79, including manufacturers of cinder units from all parts of the country as well as makers of concrete masonry units in general. A broad invitation had been extended this year, in the belief that increased activity in the concrete masonry field will bring about an increased interest in light-weight aggregates such as cinders.

Einar Christensen, of New York, president of the association and consulting engineer to the industry, acted as chairman. H. H. Longenecker, secretary of the association, took care of all arrangements.

The three major topics were:

(1) The Federal housing program and the industry
(2) Bringing the industry up to date on sales and manufacturing ideas
(3) The NRA code and the industry

Chas. F. Conn, president of the Giant Portland Cement Co., opened the convention and stressed the importance of association efforts to get the most out of the Federal housing program. D. R. Collins, of the Portland Cement Association, then gave a detailed picture of the FHA, with particular emphasis of Title II, and explained its significance to the industry. Mr. Damm, of the FHA, explained Title I, and it was brought out how cinder units may find their place in the renovating of homes, in new basements under wood frame houses, in veneering, in garages and the like added to the house. In the discussion that followed, Arthur R. Rule, well known real estate developer, related his experiences with cinder units and made it plain that it was about time for the product to find its place in the sun.

Qualities That Mean Something to Architects

Einar Christensen reported data on the particular characteristics of cinder units, especially sound absorption and heat insulation. He emphasized the fact that the fundamental qualities of the product—strength and fire resistance—had been so fully established that it was almost trivial to talk about them except in special instances, and that the industry should now go out and stress the qualities peculiar to this product and not found in competing materials. The architectural effect of painted cinder unit walls, their efficiency and economy in achieving acoustics, the insulative quality of this material, its flexibility in manufacture to serve the purpose of the architect, its old established quality of being nailable—these are the qualities that clay products do not have and can not get, and they mean something to the architect.

Dr. J. S. Long, chemical director of the Devoe and Raynolds Co., read a paper on the increasingly important question of paint applied to cinder units. He discussed applications with brush and spray gun, exteriors and inside surfaces, pigments and coloring. The ensuing discussion showed the tremendous stride that has been made by the industry in developing painted walls, first originated by one of its member plants in Detroit.

The secretary of the Code Authority, Horace W. Bush, led the session on the code and the industry. The Administrator of the code, Col. Beverly Ober, stated the points of view of the administration—supplemented by other members of the NRA—making it clear that the administration stands back of any sincere effort on behalf of industry for self government. A lively discussion followed, with questions that should be answered by the subsequent meeting of Code Authority.

Specifications That Specify

The last session was entitled "New Life for the Industry." It was led by the chairman. He pointed out the fact that increased activity in business undoubtedly would bring about the establishment of new cinder unit plants, and that it was of the utmost importance to guide these plants into making a good cinder unit. He reported on what the association has done, more particularly what has been done by the service division of the association, in furnishing sales and manufacturing service to its members. Of particular importance was a manufacturers' specification for cinders which is now being developed, and an architects' specification which has been used successfully. The latter reads:

> "Cinder units (or cinder block) herein specified shall meet the specifications of the American Society for Testing Materials, C-90-31T, and the Federal Specifications, SS-C-621, and when required for the particular job shall be approved and certified by the Underwriters' Laboratories. The units shall be so prepared from a cinder aggregate of proper gradation as to produce the surface texture and cellular structure nationally recognized by the building trade for this product, and a texture and structure acceptable to the architect, giving in addition to the required strength the sound absorption and insulation specified. The units shall be manufactured by a company belonging to a national organization recognized by the NRA, and with sufficient jobs to its credit to insure the architect of its ability to manufacture a product under conditions governed by the rules and advice of the organized cinder unit industry."

The chairman further emphasized that the selling of concrete masonry, whether cinder units or other kinds of units, had been raised to a new plane with the development of our knowledge of ashlar, of sound absorption, of insulation, and of the other qualities that are pertinent to the product. On this plane of *new salesmanship*, an association becomes of increasing importance. No individual plant is equipped to tackle these problems alone. It needs the help of some one supported by the industry. The service division of the National Cinder Concrete Products Association was established for that purpose.

1934 Index of "Concrete"

THE index for Volume 42, comprising the twelve issues of "Concrete" published in 1934, is available for distribution to subscribers requesting it.

EDITORIAL

Low-Cost Housing an Accomplished Fact

Low-cost fireproof housing is an accomplished fact. This, more than any other single item, was emphasized time after time during the annual meetings of the National Concrete Masonry Association and the National Cinder Concrete Products Association held in New York within recent weeks.

Ample proof is offered in support of this assertion. There is the so-called Woman's Home Companion house of five rooms at Westport, Conn., built of concrete ashlar masonry at a cost below $2,500, exclusive of the heating plant, and duplicated in another locality at a contract price of $4,200 for the completed structure—plumbing, heating and lighting and contractor's profit included.

The Rochester 6-room homes of concrete, built by Inter-Industries, Inc., and sold on a long-term financing basis at $4,950, are another convincing case.

Then, for the lower income groups, we have the evidence of concrete masonry houses built at Norris, Tenn., by the TVA, and in subsistence homestead projects in West Virginia and elsewhere, at costs well below $2,000 for the completed home, including plumbing, heating and lighting.

Ten or fifteen years ago such costs were undreamed of, for the simple reason that builders could not get away from the old methods of construction. Now we see frequent examples of the complete elimination of interior plaster, and in its stead we see far more attractive interior walls and partitions of painted concrete ashlar costing much less. We see fireproof floors of precast concrete joists supporting monolithic concrete slabs, built at a cost only slightly above the cost of wood-joisted floor construction. We see floors finished attractively in some form of decorative concrete, or an inexpensive covering applied directly to the structural concrete. Various other short-cuts that eliminate old methods and ideas have contributed toward simplification of construction procedure, with a consequent reduction in the cost of home building.

The groundwork has been laid for the fireproof concrete home. Concerted and co-ordinated effort will make this material an important factor in our national home-building program.

Specialists in Concrete Home Building

Another editorial on this page emphasizes the fact that the low-cost fireproof concrete home has become an actuality. A few of the many notable instances of recent date are given, in support of this assertion.

The fact remains, however, that in each of the cases cited the homes were designed by architects whose past experience taught them how to utilize concrete construction to the best advantage, with respect to economy no less than appearance.

In each case, also, the homes were built by contractors or construction crews who were trained in the new order of home building.

Here is the key to the future development of the fireproof concrete home. Each community needs architects who know how to get the most out of concrete, and contractors who are not afraid to do things in a new way.

The situation is one that invites the serious attention of progressive architects and contractors. They are presented with an opportunity to become specialists in this important branch of construction—the low-cost fireproof home. To those who will devote themselves to the study of this subject, ample assistance is available.

The A. C. I. Convention

With a total registration of 523, the annual meeting of the American Concrete Institute, held in New York from February 19 to 21, experienced its largest attendance in some years.

The quality of the attendance, moreover, was of a high grade. Among the visitors could be seen many of the men most prominent in the fields of concrete construction and cement manufacture. It was a gathering of the key men of the industry.

The success of the New York meeting was, no doubt, a reflection of the better feeling prevailing in the construction industry.

A Manufacturers' Exhibit—Why Not?

At the annual meeting of the American Concrete Institute, just closed, manufacturers of high-frequency vibrators were given an opportunity to display their wares.

While the exhibit was small and of a strictly informal character, many visitors to the convention accepted the opportunity to familiarize themselves with the various types of vibrators now on the market.

Some of the visitors expressed the hope that future conventions of the Institute might be supplemented with more elaborate exhibits of equipment for the making, placing and testing of concrete, for the manufacture of concrete products, and for related purposes.

Is there any reason why such an exhibit should not be presented? Without a question, it would provide an added attraction for convention visitors. It might be well to try out this plan at next year's annual meeting.

PROGRESS—In a Page

Current activities in research, in matters pertaining to concrete and cement, as being carried on or completed by various organized groups.

Highway Maintenance Costs

THE subcommittee on maintenance costs, appointed by the Highway Research Board, 2101 Constitution Ave., Washington, D. C., presented a progress report covering the period since the subcommittee's 1933 report. H. K. Bishop is chairman of the subcommittee.

In its recent report the subcommittee points out that maintenance sections have been selected and cost studies are being made in 37 states, although only 20 states sent in reports in 1933. The first reports for the other 17 states will be for 1934.

Although uniform cost forms were used, it is apparent from the reports received that diversity in cost accounting methods still persists and makes cost comparisons impossible without additional investigation of the data. It is now a question of clarifying some of the features of the requirements and bringing about, through criticism of submitted data, a more active interest in the completeness and accuracy of the records. An exhaustive discussion of each of the items in the report form is to be sent to each state that has commenced the study. It is expected that the 1934 reports will be more dependable than the 1933 reports, and if some of the 1933 uncertainties are cleared up, there may be some data to submit in a 1935 report of value for a two-year period.

Several phases of maintenance conditions at the present time in many states must be considered for their effect on costs. Lack of funds through diversion or for other reasons have led some states to reduce maintenance expenditures to a point utterly misleading if compared to other states able to hold to high maintenance standards. Other states have loaded the maintenance forces with relief workers until costs are out of proportion to the work performed. Adjustments must be made for greater material costs, shorter hours and higher pay than heretofore.

The Committee feels that the right beginning has been made in starting to accumulate accurate costs, in attempting to secure uniform cost accounting practice, and in making a study of such scope that every state will soon be making a special effort to collect reliable information. The mileage of the sections selected for cost studies as of September 15, 1934, includes 5,691 miles of concrete; 165 miles of brick; 2,124 miles of bituminous road; 2,013 miles of oil-processed road; 1,618 miles of surface-treated stone, gravel, sand-clay, etc.; 3,328 miles of untreated stone, gravel, sand-clay, etc.; 107 miles of top soil; and 74 miles of graded dirt roads. The total thus selected for the study amounts to 15,120 miles.

Pavement Width Affects Accidents

IN a paper presented at the fourteenth annual meeting of the Highway Research Board, held in Washington on December 5, 6 and 7, R. L. Morrison described studies of traffic accidents occurring upon 20-ft., 18-ft. and 15-ft. pavements in Washtenaw County, Michigan, during 1931. The conclusions reached, which may or may not be of more general application, are as follows:

(1) There are more accidents of all kinds on 15 and 18-ft. pavements than on 20-ft. pavements carrying similar traffic.

(2) The greatest percentage of increase is in "sideswipe" accidents. No buses were involved in this type of accident.

(3) The percentage of increase in truck and non-truck accidents is much greater than the increase in truck accidents.

From these items it is evident that wider pavements are needed much more because of passenger automobile accidents than because of truck and bus accidents.

Talking Picture Available

A talking picture, "Spinning Wheels of the Highway," has been prepared by the Portland Cement Association and is available, on request addressed to the association, for use at luncheon meetings of business men, at exhibits, or any other gatherings of people interested in highways.

The talking picture sets forth the close relation between highway construction and employment, and it emphasizes the danger to the good roads movement because of the diversion of gasoline tax funds.

Any local groups interested in this subject may obtain the picture by writing to the Portland Cement Association, 33 W. Grand Ave., Chicago.

Armstrong Heads B.S.I.

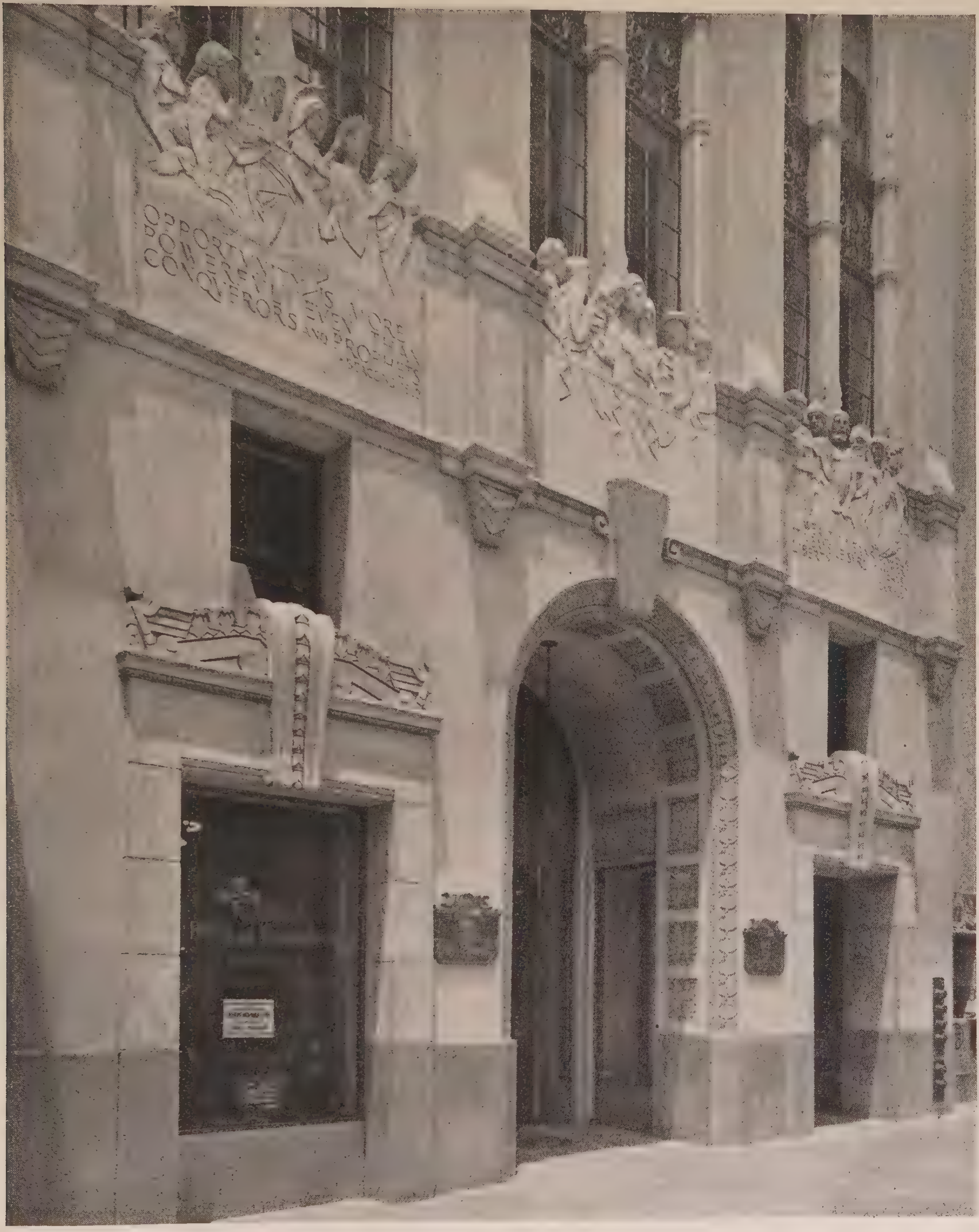
THE election of Dr. E. F. Armstrong to the chairmanship of the British Standards Institution was recently announced. Dr. Armstrong has served as chairman of the chemical divisional council of the British Standards Institution since the establishment of the chemical division in 1931. The success of the co-operative effort of the chemical industries through B.S.I. has been recognized in the advancement of Dr. Armstrong to the position of chairman of the general council. Dr. Armstrong is past president of the Society of Chemical Industry as well as past president of the Association of British Chemical Manufacturers.

International Standards Association

DURING the conference in Stockholm held by the International Standards Association in September, 1934, Professor Karl Meyer, president of the national standardizing body in Denmark, was elected president of the ISA for the period 1935 to 1938 inclusive.

Vacancies in the council of the ISA were also filled, so that the council for the period just mentioned consists of one member for each of the following countries: Austria, Denmark, Hungary, Japan, Norway, Poland and Roumania.

Architectural Concrete



Walker & Eisen, *Architects*

Colored cast stone sculpture and ornamental details, combined with portland cement stucco, produced this striking result in the National Bank of Commerce Building, in Los Angeles. All cast stone work was made in plaster waste molds

New Ready-Mixed Concrete Plant
Finds Market in Small Contracts

Older Milwaukee Producers Overlook Their Best Market While Scrambling for Large Jobs—Plant Is Model of Simplicity and Economy

WITH no less than four established plants producing and selling ready-mixed concrete in Milwaukee, a year ago, the average observer would have regarded the field as being overcrowded.

There was one firm in Milwaukee, however, that saw things in a different light when they made a study of the situation in the spring of 1934. This was the Tews Lime & Cement Co. Phil J. Bliffert, general manager of the company, who has been in close touch with the construction industry of Milwaukee for 30 years, saw that the existing ready-mixed concrete plants were overlooking their best market—that of the small contractor who wants anywhere from 3 to 50 cu. yd. of concrete at a time.

Small Contractors Favor Ready-Mixed Concrete

Events and trends of recent years led up to the study by Mr. Bliffert and his associates. To begin with, small contractors in Milwaukee were drifting more and more toward the use of ready-mixed concrete, by means of which the handling of a contract of small size is so greatly simplified. This meant that, one by one, contractors were dropping out of the market for portland cement. The Tews organization, with six material yards in various parts of the city, began to notice this trend and the consequent dropping away of their customers for cement.

But along with his growing inclination toward ready-mixed concrete, the small contractor—strange as it seems in these times—often found it a difficult matter to get delivery. While this assertion seems ridiculous when one considers the low volume of construction during the past three or four years, the fact remains that almost every small contractor, at one time or another, ran head-on into this difficulty.

Why the "Little Fellow" Had Trouble

This trouble was due mainly to the fact that the producers of ready-mixed concrete in Milwaukee centered their attention on the larger contracts—those requiring concrete in amounts running up into the hundreds or thousands of cubic yards. Then, when a producer obtained a large contract requiring, let us say, several thousand cubic yards of concrete, all the facilities of his plant were required to supply concrete as rapidly as the contractor for the big job demanded it. During the time when this large contract was being serviced, the ready-mixed concrete plant was, therefore, unable to serve its smaller customers. In consequence, the "little fellow" was confronted with the choice of either mixing his own concrete or getting it from some other ready-mixed plant with which he had no previous dealings and no established credit.

After having sized up the market situation in the field of small contracts, the Tews company officials took the next logical step by making a study of the producing and selling methods best adapted to that field.

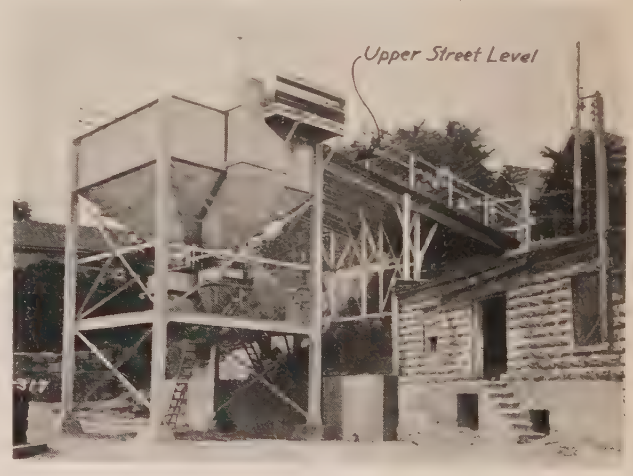
Plant Is Model of Simplicity

The answer to these questions is found in the plant built by the Tews company at its principal yard, at 1136 East North Avenue, in Milwaukee. It was put into operation on June 18.

The plant, a general view of which is shown in the illustration, is a model of compactness and simplicity—one that represents a surprisingly small capital investment—but it is capable of delivering ready-mixed concrete at the rate of one $2\frac{1}{2}$-yd. truck-load every 5 minutes, which means 30 cu. yd. an hour when in continuous operation.

Central Proportioning, Transit Mixing

The plant is the centrally-proportioning type, all concrete being mixed in transit. The hillside location of the plant simplifies the receipt of sand, gravel, and cement, these materials being delivered by truck from an upper street level and dumped directly into the storage bins in the upper part of the structure.



Ready-mixed concrete plant, with capacity of 30 cu. yd. an hour, was built at a surprisingly low cost

The aggregate bins, four in number, each have a capacity of 25 cu. yd., or a total of 100 cu. yd. The four bins are obtained by dividing the principal bin shown at the top of the structure into four compartments. Coarse aggregates are gravel, this material being kept on hand in two sizes, one with a maximum particle size of $1\frac{1}{2}$ in. and the other having a maximum size of $\frac{1}{2}$ in. Two kinds of sand—torpedo and masons' sand—occupy the remaining two bins. The cement storage bin adjoins the aggregate bins, at the same level, hugging the larger bins closely, as the illustration shows. Deliveries of cement are also made by truck at the upper street level. The capacity of the cement bin is 270 sacks.

Since the picture here shown was taken, the part of the plant below the bins and above the weighing floor has been completely inclosed.

Plant Operations

All proportioning, including aggregates, cement and water, is made by exact weight. The aggregates are dropped from the storage bins into a weigh-batcher and from there to the mixing drum of the transit mixer. Cement is weighed on a separate scale, and is likewise dropped into the transit mixer. Water is also weighed by means of a special device, and is discharged through a 3-in. pipe into the mixing drum of the truck. In this respect this plant is unique, for no water is added in transit. With all materials, including water, introduced at the plant, the mixing drum is kept revolving during the entire trip from the proportioning plant to the construction job. No dependence need be placed on the driver of the truck.

The transit mixers approach and leave the plant in a straight line, without backing, each receiving its charge as it is dropped by gravity from the weighing boxes. When the plant started operations last June, three transit mixers were put into this service; but in a very short time it was found necessary to add two more. It is expected that additional transit mixers will be needed as soon as the 1935 construction season gets under way.

The intention is, also, to add a boiler room to supply heated mixing water, and steam for heating aggregates, during cold weather. During fall and spring months only the mixing water will be heated.

Extra Price for Better Service

In working out their sales plans, officials of the Tews company adhered to their purpose of serving the small contractor. Up to the present time the company has made no effort to obtain large contracts, for the simple reason that the competition for those contracts invariably results in ruinous prices, on which the ready-mixed concrete plant can not possibly realize a profit. By serving the contractors high-quality concrete and giving them prompt delivery, the Tews organization is able to sell its concrete at a profitable price.

How Quality Is Controlled

Prompt delivery is by no means the only service feature that appeals to the customers of this plant. Before delivery is started on a contract, an engineer from the Tews organization visits the job and sees that everything is in readiness and that the proper grade of concrete has been ordered. Careful control is maintained over the quality of the plant output, so that successive mixtures are uniformly workable and of uniform strength. At various times, during the day, the aggregates are tested for moisture content in order that corrections may be made in the quantity of mixing water. The yield, likewise, is tested at intervals of a few weeks or a month, by actually dumping charges of concrete into a measured box. The purpose in this is to avoid giving either an excess or a deficiency in volume.

The question of proportions has been handled in a most understanding way. The small contractor continues to think of concrete proportions as 1:2:3 or 1:2:4, and so on, though the concrete technologist knows that in the scientific control of quality such proportions can not be considered. But why argue the point? Instead, the engineers of the Tews organization have devised tables based on analyses of their aggregates, from which they can obtain the scientific proportions corresponding most closely to the various arbitrary proportions ordered by the contractors. Thus the contractor obtains the equivalent of what he has ordered, though it is, in fact, a scientifically proportioned mixture supplied on a guaranteed strength basis.

Acknowledgments

Walter F. Tews is in charge of the ready-mixed concrete division of the Tews Lime & Cement Co. Mr. Tews, himself an experienced concrete technologist, has the further advantage of experience in selling, and in the conduct of this division of the business he has succeeded in combining these two important factors.

The transit mixers employed at this plant are of two different types—several of them are of Rex manufacture (supplied by the Chain Belt Co. of Milwaukee), while the others are the Jaeger type (made by the Jaeger Machine Co., of Columbus). The Butler Bin Co., of Waukesha, Wis., designed and supplied the plant, including the steel bins for aggregates and cement, the supporting steel frame work, the proportioning scales—and, in fact, the complete structure.

Coming Conventions

March 3-10—Leipzig Trade Fair, Inc. Spring Trade Fair with Exhibits. Leipzig, Germany. Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.

March 4-8—American Society for Testing Materials. Group Meetings. R. E. Hess, Asst. Secy., 260 South Broad Street, Philadelphia, Pa.

March 5-8—Southwest Road Show and School. 8th Annual. Wichita, Kansas.

March 6—American Society for Testing Materials. Regional Meeting. Philadelphia. R. E. Hess, Asst. Secy., 260 South Broad Street, Philadelphia, Pa.

March 12-14—American Railway Engineering Association. Annual. Chicago. E. H. Fritch, Secy., 59 E. Van Buren St., Chicago.

March 15-May 15—Chicago Better Homes Exhibit. Straus Building, Chicago. Howard J. White, General Chairman, 111 W. Washington Street, Chicago, Ill.

March 21-22—Wisconsin Concrete Products Association, Inc., 13th Annual. Pfister Hotel, Milwaukee. L. E. Schwalbe, Secy., 6332 W. State St., Wauwatosa, Wisconsin.

April 23-24—National Concrete Burial Vault Association. Annual. Statler Hotel, Cleveland, Ohio. J. H. Stuart, Secy-Treas., Bremen, Ohio.

May 4-12—San Francisco Builders Exchange. Annual Building Exposition and convention. Civic Auditorium. Frederick Weddleton, 644 Mission Street, San Francisco, Calif., Manager.

May 6-10—American Water Works Association. Annual. Cincinnati, Ohio.

June 24-28—American Society for Testing Materials. 38th Annual Meeting and Exhibit of Testing Apparatus and Related Equipment. Book-Cadillac Hotel, Detroit, Michigan. R. E. Hess, Asst. Secy., 260 South Broad Street, Philadelphia, Pa.

Express Fineness of Portland Cement in Terms of Surface Area

Use of Wagner Turbidimeter Shown in Specifications for Boulder Dam Cement—Test Procedure and Calculations

IT has long been the common practice to specify the fineness limits of portland cement by a clause stating that "the residue on a standard No. 200 sieve shall not exceed 22 per cent, by weight."* Actually, of course, practically all present-day brands of portland cement are considerably finer than the limit just quoted, most of them leaving less than 10 per cent of residue on the No. 200 sieve.

Fineness Expressed as Surface Area

Users of cement, however, are well aware that the specification requirement quoted in the foregoing paragraph has little meaning, for the reason that no information is provided concerning the cement that passes the No. 200 sieve—more than 90 per cent of the total. As a result of this situation, men in the field of research have devoted much time to the development of devices to supply more complete information. This has been accomplished by developing means for determining the total surface area of the particles, expressed in square centimeters per gram of cement.

Among the devices developed, the Wagner turbidimeter has won much favor; and this apparatus is specified in Specifications No. 566, recently issued by the U. S. Bureau of Reclamation in its specifications covering the cement for Boulder Dam. In view of this recognition of the Wagner turbidimeter by this important branch of the federal government, the description of the apparatus and the test procedure prescribed in Specifications No. 566 are given in the paragraphs that follow.

APPARATUS

The Wagner turbidimeter consists essentially of a source of light of constant intensity adjusted so that approximately parallel rays of light pass through a suspension of the cement to be tested and impinge upon the sensitized plate of a photo-electric cell. The current generated by the cell is measured with a micro-ammeter and the indicated reading is a measure of the turbidity of the suspension. General considerations indicate that turbidity is in turn a measure of the surface area of the suspended sample of cement.[1] The apparatus shall consist specifically of the following parts:

(1) *Turbidimeter.*—This shall be mounted in a suitable case, and shall include the following features:

(a) *Source of light.*—The source of light shall consist of a 3 to 6 candle-power concentrated filament electric lamp operated by a 6-volt storage battery. A parabolic reflector shall be mounted behind the lamp and the lamp focused in such a manner that approximately parallel rays of light will pass through the sedimentation tank and will impinge upon the photo-electric cell. The light intensity shall be regulated by means of two rheostats having resistances of approximately 6 and 30 ohms respectively and mounted in series with the lamp but in parallel with each other.

(b) *Water cell.*—The light shall pass through a water cell before entering the sedimentation tank in order that radiant heat from the beam shall be absorbed. The cell shall consist of 3-in. brass tubing, 4 in. long with glass windows cemented in the ends with a suitable sealing material. A stoppered hole in the top of the cell shall provide for filling with distilled water. The cell shall be so arranged that all rays of light from the source shall pass through the water before entering the sedimentation tank.

(c) *Retarding filter.*—A colored glass shall be provided which will reduce the intensity of light from that corresponding to 100 micro-amperes to a reading of 20 to 30 micro-amperes. An Eastman filter No. 35D has been found suitable.

(d) *Sedimentation tank.*—The sedimentation tank shall be constructed of 3/16-in. plate glass cemented together to form a rectangular tank having inside dimensions 2 by 1½ in. by 8 in. The 2-in. faces of the tank shall be placed normal to the beam of light, and shall be equidistant within 0.003 in. at all points. A mark shall be placed on the side of the tank to indicate a volumetric content of 335 ml., which is the level to which the tank will be filled in a test.

(e) *Photo-electric cell.*—The means of measuring the light intensity shall be a sensitive photo-electric cell (Weston Photronic type) connected directly to a micro-ammeter. A hood with a horizontal slot ½ in. high by 1⅜ in. wide shall be mounted over the face of the photo-electric cell.

(f) *Shield.*—A metallic shield having a slot approximately ⅝ in. high by 1½ in. wide shall be placed between the water cell and the sedimentation tank.

(g) *Elevating device.*—The source of light, water cell, photo-electric cell, retarding filter and shield shall be mounted on a movable shelf which is raised or lowered by two connected lead screws so that the turbidity of the suspension may be determined at any desired depth. The sedimentation tank shall be mounted on a base which is independent of the rest of the apparatus so that the tank shall be free from vibration caused by moving the shelf. The level of the light beam with reference to the surface of the suspension shall be indicated by a pointer which will travel along a scale mounted on the cabinet. The zero of the scale shall indicate that position at which the center lines of the slots for the light beam are at the same elevation as the surface of the liquid in the tank when filled to the 335 ml. level. The interior of the turbidimeter cabinet and the exterior surfaces of the shelf, parabolic reflector, water cell, shield and photo-electric cell hood shall be painted with a dull optical black paint.

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*A. S. T. M. Specification C9-30.

[1] The Wagner turbidimeter was developed by L. A. Wagner, research associate of the cement reference laboratory at the National Bureau of Standards, Washington, D. C. A description of the apparatus and mathematical derivations of formulas used are given in the paper, "A Rapid Method for the Determination of the Specific Surface of Portland Cement," by L. A. Wagner, *Proceedings* of the American Society for Testing Materials, Volume 33, Part II, 1933, page 553.

(2) *Micro-ammeter.*—The micro-ammeter shall be especially constructed for use with the turbidimeter,[2] shall have a range of 0 to 50 micro-amperes and shall be graduated in such a manner that readings may be made with an accuracy of 0.1 micro-ampere. The internal resistance of the micro-ammmeter shall not be greater than 100 ohms.

(3) *Battery.*—A 6-volt storage battery shall be used for supplying current to the lamp. An approved automobile type may be used.

(4) *Sieving apparatus.*—The sieving apparatus shall consist of a U. S. Standard No. 325 sieve, 2 or 3 in. in diameter and having sidewalls 3 or 4 in. high. A spray nozzle having seventeen 0.02-in. holes in the tip shall be used for washing the sample through the sieve. A pressure gage shall be installed in the water line between the shut-off valve and the nozzle so that pressure on the nozzle can be regulated.

(5) *Stirring apparatus.*—The stirring apparatus shall consist of a brush, which will fit the contour of the bottom of a test tube, attached to a stirring motor. The brush shall rotate at a speed of approximately 500 r.p.m.

(6) *Timing burette.*—The time of settling for the different sizes of particles shall be obtained from a burette from which kerosene is allowed to flow. The burette shall consist of a glass tube of about 18 millimeters inside diameter and one meter in length. A capillary about one millimeter in diameter and of sufficient length to drain the burette in about 15 minutes shall be fastened in the bottom of the larger tube by means of a cork stopper. A line to be known as the zero level shall be marked or etched on the burette about 20 centimeters from the top. Precautions should be taken to prevent clogging of the capillary outlet with foreign material, or erratic surface area values will be obtained. Trouble from this source can be detected by checking the time of flow with a stop watch.

(7) *Suspending liquid.*—At least 20 gallons of any clear white kerosene shall be set aside for use with the turbidimeter apparatus.[3]

TEST PROCEDURE

(1) *No. 325 sieve determination.*—A No. 325 sieve determination shall be made on a fresh 1-gram sample of the cement, the per cent passing to be denoted as "*r.*"

(2) *Size of test sample.*—A 0.3-gram sample of the cement to be tested shall be used for a very fine cement (more than 85 per cent passing a No. 325 sieve), 0.4 gram for a medium cement (70 to 85 per cent passing a No. 325 sieve) and 0.5 gram for a coarse cement (less than 70 per cent passing a No. 325 sieve).[4]

(3) *Operation.*—

(a) With retarding filter and sedimentation tank containing approximately 100 ml. of clear kerosene in the light path, the light shall be adjusted to the proper intensity, I_0, by taking repeated readings at one-minute intervals until an unchanging value shall indicate that the lamp and photo-electric cell are in equilibrium.

(b) The proper size of sample of cement shall be weighed out and a suspension prepared, adding the mixture, the wash kerosene, and the additional kerosene to that already in the sedimentation tank.

(c) The pointer shall be placed at the 30-60 micron (15 cm.) position.

The burette shall be filled with kerosene and oscillation started. The oscillation shall continue until the kerosene drains to the zero line on the burette, when agitation shall cease, and any kerosene which has drained down outside of tank shall be wiped away. The tank shall be immediately placed in position in the path of the light beam.

(e) The retarding filter shall be removed from the light path and the cabinet door closed.

(f) The micro-ammeter shall be read at the instants the kerosene in the burette drains past marks 60, 55, 50, 45, 40, 35, and 30.

(g) The shelf shall then be raised successively to the marks 25, 20, 15, 10, and 7.5 on the pointer scale, the micro-ammeter being read at each position as the kerosene drains past the corresponding mark on the burette.

(h) The filter shall be replaced in the path of the light beam, the tank removed and the intensity of the lamp checked.[5]

CALCULATION OF RESULTS

A suggested form for recording test values and calculated results is here outlined. The following methods of calculation shall be used.

(1) *Calculation of transmittancy constant.*—The value of the transmittancy constant shall be computed from the equation:

$$C = \frac{38r}{1.5 + 0.75 \log I_{7.5} + \log I_{10} + \log I_{15} \,..\, \text{etc.} + \log I_{55} - 11.5 \log I_{60}} = \underline{\qquad\qquad}$$

wherein:

C = transmittancy constant.

r = per cent, by weight, of sample passing No. 325 sieve.

---

[2] A micro-ammeter suitable for this purpose may be obtained from the Rawson Electrical Instrument Co., Cambridge, Mass.

[3] A change in the supply of kerosene necessitates a recalibration of the apparatus. The used kerosene may be reclaimed by allowing the cement to settle and siphoning off the clear liquid. The kerosene can be decolorized if necessary by stirring in some filter charcoal before settling. Reclaiming the kerosene in this manner does not change its viscosity or density and recalibration for its re-use is not required.

[4] The size of sample is selected so that the micro-ammeter readings will fall in the middle portion of the micro-ammeter scale.

[5] If the intensity of the lamp has shifted more than 0.3 micro-amperes from the initial setting (I_0), the test must be repeated. A freshly charged storage battery should be momentarily short-circuited to reduce the voltage to constant value. If the intensity of the lamp continues to fluctuate, look for loose connections in the lamp circuit, see that the rheostat contacts are clean and make certain that the lamp and socket are rigidly fixed in their mounting.

$I_{7\cdot5}$, I_{10}, I_{15}, etc. = micro-ammeter readings which correspond to particle sizes 7.5, 10, 15, etc., microns.

SUGGESTED FORM FOR RECORDING RESULTS OF TEST FOR FINENESS WITH WAGNER TURBIDIMETER

Fineness analysis of .... brand cement,
Bin No. .... Sampled ....
Tested .... Operator ....
Weight of sample tested .... grams.
Per cent passing No. 325 sieve .... per cent (Wet method)
Filter reference before test .... micro-amperes.
Filter reference after test .... micro-amperes.
Temperature, room .... Deg. C., suspension .... Deg. C.

Depth (h) cm.	15	15	15	15	15	15	15	13.1	10.0	6.6	3.3	2.1
Diameter (d) microns	60	55	50	45	40	35	30	25	20	15	10	7.5
Micro-amperes I_d												
Log I_d												

Transmittancy constant:

$$C = \frac{38r}{1.5 + 0.75 \log I_{7\cdot5} + \log I_{10} + \log I_{15} \ldots \text{etc.} + \log I_{55} - 11.5 \log I_{60}} = \_\_\_\_\_\_$$

Specific surface:
$S = C\ (2 - \log I_{60}) =$ .... sq. cm. per gram.
Computed by .... Checked by ....

(2) *Calculations of specific surface.*[6]—The specific surface shall be computed from the equation:

$$S = C\ (2 - \log I_{60})$$

wherein:

S = specific surface of the cement in square centimeters per gram.
C = transmittancy constant as determined above.
I_{60} = micro-ammeter reading corresponding to a particle size of 60 microns.

(3) *Calculation of the specific surface of successive samples of cement from the same plant.*—After the transmittancy constant C for a cement from a given plant has been definitely established, the specific surface of successive samples from the same plant can be quickly obtained by observing only the first turbidity reading, I_{60}, of the subsequent suspensions and solving the equation[7]:

$$S = C\ (2 - \log I_{60})$$

wherein:

S = specific surface in square centimeters per gram.
I_{60} = micro-ammeter reading corresponding to a particle size of 60 microns.
C = Average transmittancy constant for the particular plant as established by several previous complete tests.

The tests shall be carried out with such accuracy that the individual values of three determinations of any sample shall not vary from their average by more than 3 per cent. Likewise, the average of three determinations using the standard sample shall not vary from the value assigned for such a sample by more than 2 per cent.

The chemical and physical properties of Boulder Dam cement were discussed in an article in the May (1934) issue of CONCRETE, pages 15 and 16, while in the August (1934) issue, pages 15 and 16, will be found the method prescribed in Specifications No. 566 for determining the heat of hydration of cement.

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[6] The Wagner apparatus may also be used for obtaining particle size distribution. The details are fully explained in the paper, "A Rapid Method for the Determination of the Specific Surface of Portland Cement," by L. A. Wagner, *Proceedings* of the American Society for Testing Materials, Volume 33, Part II, page 553.

[7] This method may be used provided there is no great change in fineness, and hence no change in the size of test sample, and no great change in chemical composition between the successive samples.

Missouri Pacific's Casting Yard Produces Huge Precast Concrete Units

THE August (1934) issue of CONCRETE, pages 7 and 8, contains an illustrated article describing the casting of hollow reinforced concrete piles of large size at the casting yard of the Missouri Pacific Railway at Little Rock, Ark. The piles there described were cast partly as an experiment, and were successfully used in the construction of bridge piers and abutments at Dupo, Ill.

Aside from these special piles, the Missouri Pacific used a great number of reinforced concrete piles during 1934. The illustration shows a view of the railway company's casting yard, with huge reinforced concrete piles at the left, precast bridge deck slabs in the center of the picture, and trestle bents at the right.

View of casting yard of Missouri Pacific Railway at Little Rock, Ark., where large reinforced concrete piles, bridge deck slabs and other heavy concrete units are cast for use in railway structures

During 1934 the company cast and used about 2,000 24-in. reinforced concrete piles of various lengths, ranging from 24 to 60 ft.

In the casting operation, concrete is delivered from a ready-mixed concrete plant to two unloading dumps, then distributed by concrete buggies to the molds. Any surplus concrete left over after the pile forms are filled is used for retaining wall units and other small uses, or for the gradual paving of the surface of the casting yard.

Joints for Concrete Highways

Demand Use of Engineering Principles

Recent Trend in Concrete Highway Joints Favors Watertight Types Developed for Reinforced Concrete Bridge Floors—Dowels Recommended

By L. J. MENSCH
Consulting Engineer, Chicago, Illinois

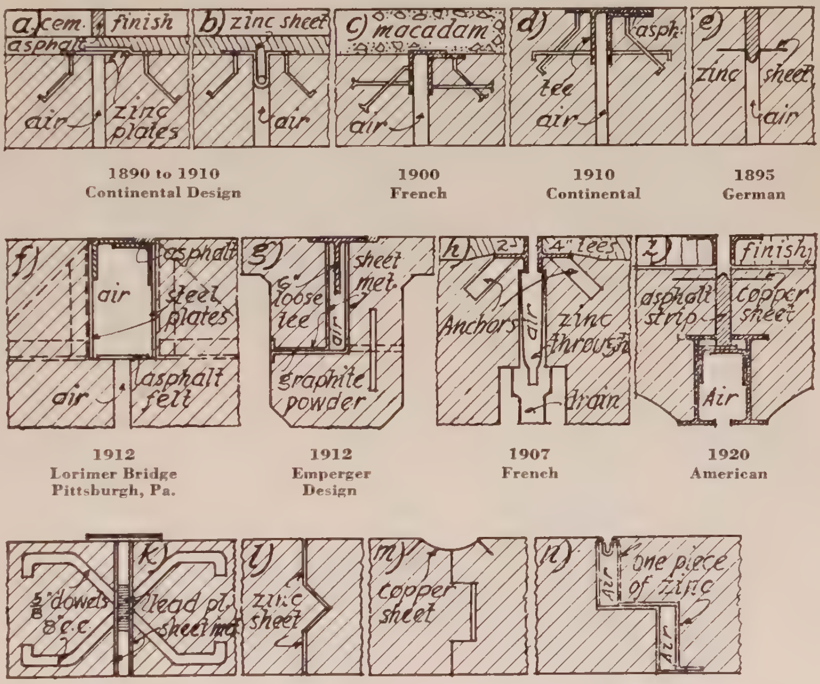
IN the January issue of CONCRETE, in the first installment of this article, the writer set forth the inadequacy of joints in concrete highways, especially those installed prior to about 1925. More recently, highway engineers have begun to realize the need for better engineering design in joints, and they have turned to the better types of joints used in reinforced concrete bridge floors as a means to this end. Figure 2 shows some successful bridge joints, while Figure 3 shows how these have been modified to meet the needs of highway joints. While the present installment concludes this discussion, more detailed treatment will be found in the writer's recently published book[1] covering this subject, and from which this article is taken.

Better Joints in Concrete Bridge Floors

Much better joint designs are found in steel bridges with concrete floors, and in reinforced concrete bridges, where the same problem of providing for expansion and contraction of concrete slabs due to temperature and moisture variation occurs. Bridges costing from $20 to $100 per sq. yd. and more have by all means to be guarded against cracks, spalling and water entering joints; such water often finds outlets below and at the sides and reaches visible surfaces and produces unsightly stains from efflorescence and dirt. Many designers contented themselves with safeguarding only the movements of the adjoining concrete members. More experienced designers made the joints water and dirtproof.

Figures 2 (a) to 2 (m) show quite a number of such designs.

In the last 20 years engineers became aware that there are much greater vertical movements in concrete slabs than ever imagined. The most serious movements are due to frost action. It is to the credit of the Universal Atlas Cement Co. that they undertook an elaborate investigation at a newly built road in Kenilworth, Ill., in order to learn something definite about such movements. The road was 3,325 ft. long and 40 ft. wide and was built on a subgrade composed on part of common clay, and part of it of sandy loam, and part of the subgrade had a 3-ft. top layer of beach sand. A total of 4,176 elevations were taken from October, 1916, to October, 1917. The whole pavement, about 40 ft. wide, moved up in winter, the greatest rise being on clay soil and at the edges of the road, and it amounted to 1½ in. The center of the road, which had no artificial longitudinal joint, did not rise as much as the edges by about ⅝ in. On the sand subgrade



1890 to 1910 Continental Design; 1900 French; 1910 Continental; 1895 German

1912 Lorimer Bridge Pittsburgh, Pa.; 1912 Emperger Design; 1907 French; 1920 American

1910 3-Hinged Arch; 1904 German; 1920 American; 1920 German

Figure 2. Some types of successful joints in reinforced concrete bridge floors

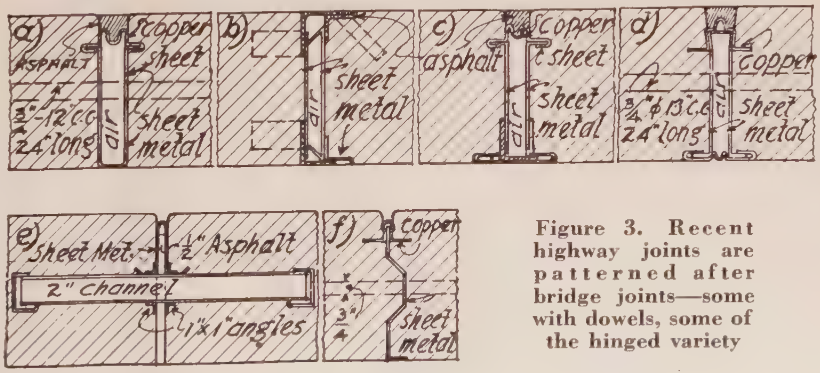


Figure 3. Recent highway joints are patterned after bridge joints—some with dowels, some of the hinged variety

the rise of the slab was about 75 per cent of the above figures. In the month of May the slab returned substantially to the grades of the previous October and remained so during summer and early fall.

---

[1] *Joints for Concrete Pavements*, by L. J. Mensch, Consulting Engineer, Chicago.

These findings were confirmed by thorough investigations by Prof. F. H. Eno of road conditions in the State of Ohio, and by observation at the Bates experimental road in Illinois.

Joints Must Be Watertight

It was now obvious to engineers that water must be prevented from reaching the subgrade through cracks and joints, because frost action might form ice lenses under the joints and cracks and cause local heaving quite different from the general heaving of the frozen subgrade; entering water caused also another serious trouble, namely, the softening of the subgrade; trucks which depress the ends of the slabs at the joints or cracks, often ⅛ in. and more, exert a kind of a pumping action on the soft subsoil and force water mixed with soil through the cracks to the surface, causing in time considerable cavities which leave the slabs unsupported.

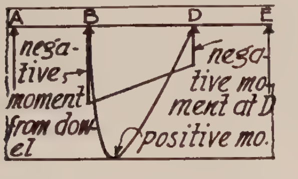


Figure 4. Bending moments under wheel loads are reduced if dowels are stiff enough to transmit some of moment across joints

Another serious defect made an early appearance—blow-ups. Where expansion joints were used only several hundred feet apart and the cracks caused by contraction were not cleaned out, and in closer spacing at least twice a year covered by the asphalt, or where many joints were similarly neglected, a few years after the construction of the roads the joints and cracks were filled with compressed mineral matter and resisted expansion of the concrete to such an extent that the slabs buckled up mostly at or near the joints, or at a change of grade.

Bridge Joints Adapted to Highways

We have shown in Figure 2 that most bridge joints were carefully protected against entering of mineral matter; and highway engineers now considered it necessary to adapt joint designs, as shown in Figure 2, for concrete roads. They did not get much encouragement from the public. Naturally, such joints were more expensive than asphalt strips and a few dowel bars, and the claim was made that it was much more economical to let the roads blow up occasionally and repair them, than to spend money on joints. It became a very poor argument when motorists had their lives endangered by such blow-ups and when damages to vehicles were occasioned also.

The United States Bureau of Public Roads finally settled the matter by sending out the following letter, dated March 3, 1934, which we bring in abstract:

> MEMORANDUM TO DISTRICT ENGINEERS:
>
> The Bureau is convinced that adequate provisions for expansion and crack control in concrete pavements not only adds to their expected life but reduces maintenance costs and permits such pavements to carry designed loads without progressive deterioration.
>
> In approving the expenditure of Federal funds for concrete pavements on future projects, therefore, it will be required that:
>
> (1) Expansion joints be used at intervals not greater than 100 feet, providing expansion openings not less than three-quarter inch nor greater than one inch.
>
> (2) Provision be made for load transfer across expansion joints, either by the use of dowel bars or other devices which will accomplish the same purpose.
>
> Dowel bars must be accurately held in place perpendicular to the plane of the cross-section of the pavement; treated to break bond and provided with metal caps on one end to give sufficient air space for movement in the slab. Continuous sleeves covering one-half the length of the bars will not be permitted.
>
> (3) Provision be made for crack control between expansion joints by the use of steel reinforcement, or suitably designed transverse contraction joints or planes of weakness so spaced that the distance between such contraction joints or expansion joints does not exceed 30 ft.
>
> In order to prevent the infiltration of inert materials into openings provided in pavements for expansion purposes it is essential that some form of adequately sealed joint be used, or that the joint filler be highly resilient. Poured joints of bituminous materials or preformed joint fillers which are permanently extruded as the pavement expands cannot be expected to give satisfactory service over long periods.
>
> Provision must be made for load transfer across contraction joints or planes of weakness. The slabs must be free to move at such joints or planes of weakness. It is recommended, therefore, that smooth round dowels, 24 in. in length, and treated to destroy bond, be used across contraction joints or planes of weakness. The size and spacing of the dowels should be the same as would be required for expansion joints. Metal caps to provide air space are not necessary.
>
> Present indications are that a type of joint which can be sealed on top and sides against the passage of surface water to the subgrade is particularly desirable for use in connection with pavements constructed on certain types of subgrade soils which change volume substantially with an increase in moisture.
>
> Thos. H. MacDonald
> Chief of Bureau.

Figures 3 (a) to 3 (f) show better types of joints which were used before the above letter was sent out. They comply with the Bureau's requirement, more or less, for a longer or shorter time. The reader can see that two main types of joints are shown; one type has dowels, the other type is more of the hinged variety. Which is the better type?

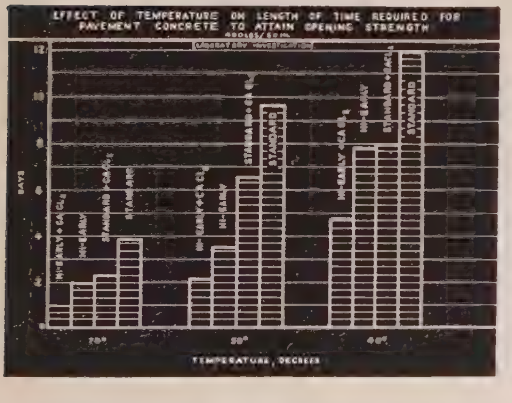
Strong Dowels Needed

Our answer is the dowel type, *provided the dowels are strong and stiff enough and really placed parallel in a horizontal and vertical direction to the movement of the slab*, due to temperature and moisture variation.

Why? It is very simple. Every engineer knows that a continuous beam is stronger and stiffer than a beam of the same size and span, freely supported. If we make the dowels stiff enough to transmit a considerable bending moment from one slab to the adjacent slab, we are allowed in the design of a loaded slab to deduct from the bending moment produced by the loads a great part of the negative moment which the dowels are able to transmit by their own proper strength as may been seen from Figure 4.

But how to design the dowels? There does not exist any acknowledged theory on the subject, only unproved speculations; neither have any tests been published which are of value for design purposes; therefore, the writer decided to make a number of tests in order to find a solid basis for a proper analysis. This part of the problem will not be treated in this article, although the subject is covered in the writer's book, mentioned in the opening paragraph of this concluding installment.

Lift COLD-WEATHER HANDICAPS FROM CONCRETE CURING



CALCIUM CHLORIDE ASSOCIATION

THE DOW CHEMICAL COMPANY
Midland, Michigan
THE COLUMBIA ALKALI CORP.
Barberton, Ohio
MICHIGAN ALKALI COMPANY
60 E. 42nd St., New York City
SOLVAY SALES CORPORATION
61 Broadway, New York City

NO LONGER need concreting operations wait for warm weather. The results of innumerable researches and tests made during the past decade show conclusively that Calcium Chloride incorporated in the mix so controls the effect of low temperatures that early, economical and efficient concrete curing can be readily achieved in *any* season. Reports of investigations by the National Bureau of Standards, the Highway Research Board, the U. S. Bureau of Public Roads, the Highway Department of the District of Columbia, the Ohio State University, the Portland Cement Association, and various state organizations, all confirm the practical value of Calcium Chloride in all paving or structural concrete.

Such widely assembled data, supported by years of actual use in the field, give positive assurance that Calcium Chloride incorporated in standard Portland or high-early cement concrete mixes, effects these invaluable advantages:

1. *By accelerating the rate of hardening, concrete attains higher strength than is otherwise possible in low or changing temperatures.*
2. *Shortens by approximately one-third the safe opening-strength time at 40° to 50° F. Makes heating of materials seldom necessary and reduces the length of time expensive covering may be required.*
3. *Maintains a more constant moisture content and controls volume changes from the time the concrete is placed—resulting in greater density, and uniformity.*
4. *Increases workability—permitting lower water-cement ratio mix design, thereby increasing durability and strength.*

Such benefits from the use of Calcium Chloride in concreting are inestimable. The contractor saves money in labor, equipment tie-ups and earlier job completion. The public obtains earlier use of highways. The construction season can be lengthened to a major degree—with utmost confidence as to anticipated results. WRITE for further literature, statistical information and evidence, addressing any of the Members of this Association.

CALCIUM CHLORIDE *for modern concrete curing*

HOW TO DO IT

◆ Questions and Answers ◆
Consultation and Comment

A department devoted to the solution of problems encountered in concrete work. Readers are welcome to add to or improve upon the suggestions printed and to submit their views for possible publication.

Markets for Concrete Burial Vaults

We are informed that a recent bulletin issued by the U. S. Department of Commerce made mention of various articles published in CONCRETE *on the subject of markets for concrete burial vaults. Can you refer me either to the articles or to the bulletin?—C. P. M., Atchison, Kans.*

The United States Department of Commerce published the market analysis to which you refer in its Commerce Bulletin issued in January, 1935. The articles in CONCRETE were published in the following issues:

August, 1934—Nation-Wide Merchandise Program to Reach Concrete Burial Vault Market—Pages 20-22.

September, 1934—Here Lies the Market for Concrete Burial Vaults—Pages 13-14.

June, 1933—Prospective Market for Concrete Burial Vaults—Page 18.

August, 1933—Surface Sepulcher, a Distinctive New Concrete Product—Page 20.

Testing Concrete Cylinders

Have you any information on the testing of concrete cylinders, suitable for use in a city building inspection department?—D. B. C., Hampton, Va.

The nationally-accepted method of testing concrete cylinders will be found in the following standards issued by the American Society for Testing Materials:

(1) Standard Method of Making and Storing Compression Test Specimens of Concrete in the Field (Serial designation C31-33).

(2) Standard Method of Making Compression Tests of Concrete (Serial designation C39-33).

The above standards are included in the 1933 Book of A. S. T. M. Standards; but separately printed copies of individual specifications may be obtained at 25 cents each from the American Society for Testing Materials, 260 South Broad St., Philadelphia.

Standardized Metal Forms

I find very little data available on metal form work except through manufacturers' literature. Will you kindly put me in touch with manufacturers of such forms, particularly of the standard panel type?—S. C. E., Auburndale, Mass.

A list of manufacturers of metal forms is being forwarded to you. It is true that the few books available on the subject of concrete form work treat metal forms in a rather incidental way. If you have access to back numbers or bound volumes of CONCRETE you will find several excellent articles on standardized metal forms in the issues of June, July, August and October, 1931. Additional articles have, of course, been published at other times, but the four articles mentioned contain complete details and descriptions of the working procedure involved in the erection and removal of standardized metal forms.

An All-Purpose Concrete Handbook

I am looking for a concrete handbook that covers the design of miscellaneous concrete construction work such as box, circular and egg-shaped culverts of reinforced concrete, small highway bridges designed as rigid frames, footings, piers, wing walls and abutments, and sidewalk and paving slabs. All the text-books on concrete which I have seen are written by authors who take too much for granted. They cover certain types of large reinforced concrete structures, at the same time ignoring or passing up lightly the numerous miscellaneous structures that form so large a part of concrete construction work.

If you can refer me to an all-round handbook on concrete design, suitable for the engineer who is not designing structures every day, I shall appreciate it. T. S. O., Muscatine, Iowa.

It would be desirable, though quite impossible, for a single book to cover all the ground you mention. For this reason, many books on concrete engineering design are definitely confined to certain types of structures, such as rigid-frame or arched reinforced concrete bridges.

To cover the entire subject, a set of several volumes is needed. Several such sets will be found in the full-page lists of "Books on Concrete," appearing in the various issues of this magazine. By studying these lists you should be able to make a selection of books that will meet your needs.

Movable Forms for Circular Concrete Bins

Can you refer me to a good book or to magazine articles on details of movable forms for circular concrete bins?—E. B. C., Tacoma, Wash.

Articles by Richard T. McKay, on "Details of Movable Forms and Their Operation," appear in CONCRETE in the issues of April (1931), pages 12 to 14, and May (1931), pages 33 to 36. Another article by the same writer, on "How Movable Forms Are Taken Down," appears in the September (1931) issue, pages 11 and 12. These articles are well illustrated with detailed drawings, and a clear description is given of the working procedure.

The Wagner Turbidimeter

We are interested in the Wagner turbidimeter as an apparatus for determining the fineness distribution of cement. Is this equipment generally accepted and is it being manufactured in the United States? If so, we shall appreciate receiving the name and address of the manufacturer.—E. R. S., Railton, Tasmania.

The equipment to which you refer has gained considerable favor in the United States. It is commercially available, and we are asking the manufacturer to send you his printed circulars.

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Smoothly Spreads Stone, Macadam and Bituminous - 1″ to 7″ Thickness, 8 to 11 Ft. Widths

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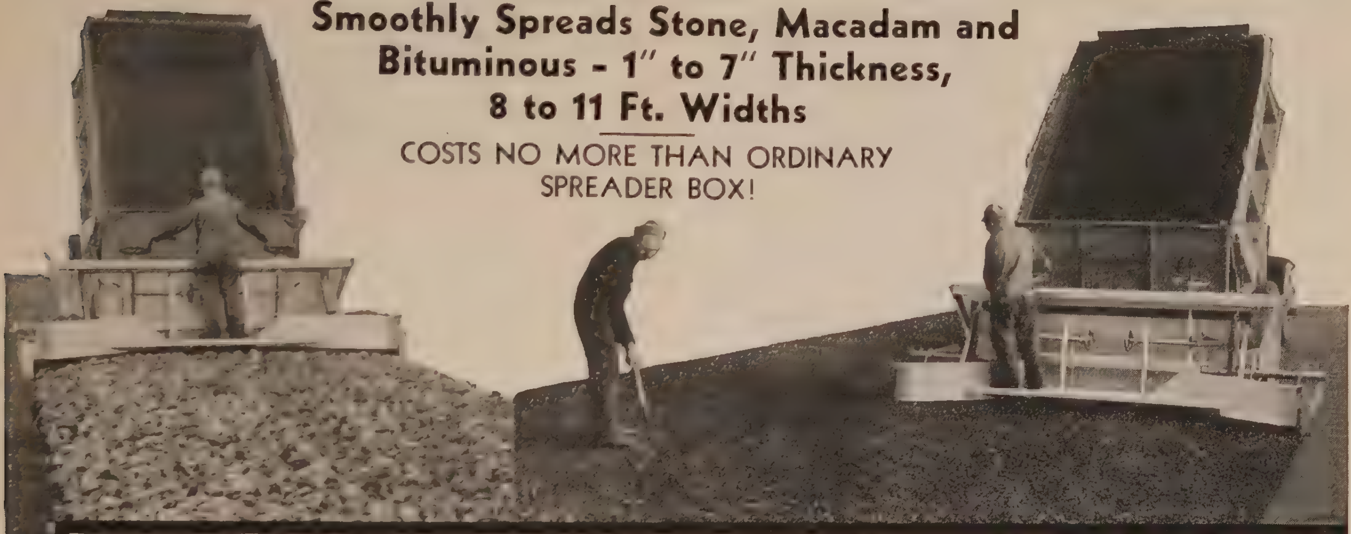

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Insures perfect bond for black top.

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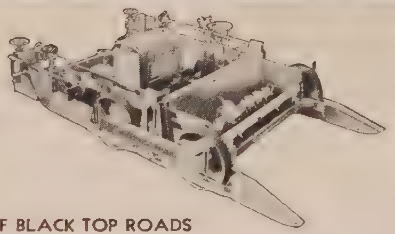

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◆ CODE NEWS FOR THE INDUSTRY ◆

Addresses of Code Authorities

FOLLOWING are the addresses of the code authorities of industries and branches of industries related or of interest to the concrete construction industry. When writing to a code authority, include the words "code authority" in the address, thus: Code Authority, Construction Industry, National Press Building, Washington, D. C.

Builders' Supplies Trade, Room 1907—Investment Building, Pittsburgh, Penna.
Cement-Gun Contractors Industry, 5550 Bartlett Street, Pittsburgh, Penn.
Concrete Burial Vault Industry (Chairman of Code Committee is L. A. Chick, care of Blairsville Concrete Products Co., 100 North East Lane, Blairsville, Penna.)
Concrete Masonry Industry, 211 Edgemont Place, Teaneck, N. J.
Concrete Mixer Manufacturing Industry, 221 W. Madison St., Chicago, Ill.
Concrete Pipe Industry, 33 W. Grand Ave., Chicago, Ill.
Construction Industry, National Press Building, Washington, D. C.
Construction Industry, National Press Building, Washington, D. C.
Construction Machinery Distributors Trade, 207 W. Pearl Street, New York, N. Y.
Crushed Stone, Sand and Gravel, and Slag Industry, Munsey Building, Washington, D. C.
General Contractors' Industry, 222 Munsey Building, Washington, D. C.
Portland Cement Industry, 111 W. Washington St., Chicago, Ill.
Ready-Mixed Concrete Industry, 951 Munsey Bldg., Washington, D. C.
Reinforcing Materials Fabricating Industry, 201 North Wells Street, Chicago, Ill.
Steel Joist Industry, 201 N. Wells St., Chicago, Ill.
Waterproofing, Dampproofing, Caulking Compounds and Concrete Floor Treatments Industry, 11 West 42nd St., New York, N. Y.

Good Results from Code of Aggregates Industry

PROBLEMS facing the code authority for the crushed stone, sand, gravel, and slag industries were explained by Otho M. Graves, recently re-elected general code authority, at the joint annual meetings of the National Crushed Stone, National Sand and Gravel, and National Slag associations at the Palmer House, Chicago, on January 30.

Mr. Graves said the code has worked out as well as that of any other industry. In the case of the three lines represented at the meetings, he asserted, operation of the code has resulted in reasonable stabilization in the industry and has increased the number of employes 25 per cent and payrolls 27 per cent. He said this was especially noteworthy since the industry is among those included in the durable goods line and one of the industries hardest hit by the depression.

Code Enforcement to Be Expedited

THE National Industrial Recovery Board is moving definitely to assist government representatives and code authorities to effectuate code compliance. It has appointed Sol A. Rosenblatt as director of field administration and enforcement. He is to co-ordinate activities of the compliance and litigation divisions and co-operate with other governmental agencies. Ten regional compliance offices are being set up to receive reports of the state compliance directors, to adjust difficult cases, and when necessary, to start court proceedings. A. G. McKnight, special assistant general counsel, is making nationwide survey of conditions bearing on code operation and enforcement.

Home Exposition Extended

THE Modern Home Exposition, which opened February 16 at the Coliseum, Chicago, and was to have closed its doors on February 24, was continued for another week. It will remain open through Sunday night, March 3, according to Harry H. Potts, operating manager of the show, who states that to date 25,000 people have entered the Coliseum and that approximately $300,000 in orders for merchandise have been taken by exhibitors.

Visitors have registered from as far as the state of Washington in the west and Pennsylvania in the east. The bulk of the attendance, however, is from Illinois, Indiana, Michigan, Wisconsin, Iowa and Ohio.

Two Months Housing Exhibit

A TWO-MONTHS exhibit, admission free, of building material and supplies, home equipment and furnishings is being sponsored by the Chicago Committee, Better Housing Program, co-operating with the Federal Housing Administration, Washington, D. C.

The exhibit—in the Straus Building Exhibit Hall—will include everything used in the construction of new homes or the repair and modernization of existing buildings. The exhibit is planned to give all Chicago home owners or prospective builders an opportunity to see the latest and best in materials and equipment as they are making their plans for the spring building season.

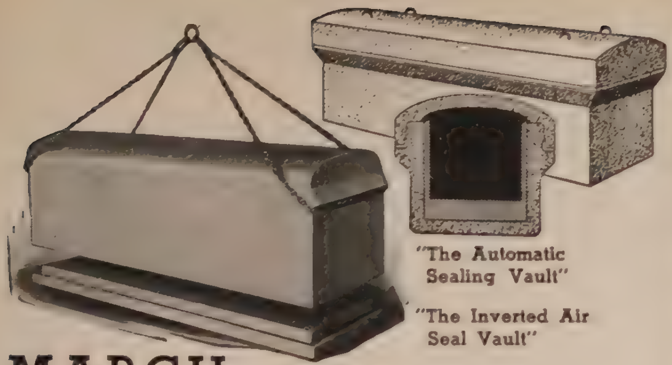
Headquarters of The Chicago Better Homes Exhibit are at Room 348, 111 West Washington Street, Chicago. Howard J. White, of Graham, Anderson, Probst & White, is general chairman.

From the Patent Office

Uniformly colored cement: A. L. Asher, Milwaukee, Wis. U. S. Pat. 1,963,540.—That step in the process of manufacturing a uniformly colored cement resides in grinding cement clinker to produce cement and then continuing the grinding to a point where the cement will float in a like gaseous medium of equal velocity with the coloring matter employed, and then mixing.

●

Acid proof masonry: Karl Daimler, Frankfort, Germany. U. S. Pat. 1,962,483.—The masonry comprises non-acid proof stones coated with coarsely dispersed bitumen emulsion prepared by means of humic acid, the spaces between said stones, being filled with mortar consisting of an intimate mixture of mineral powder and a coarsely dispersed bitumen emulsion prepared by means of humic acid.



MARCH
Is the Money-Month
Get Started Today

March pays better than any other month. It is right ahead of you. Start the year's business with the year's best profits. Perhaps you could make enough to win back your capital at once. Then anything you earned would be clear profit. Only one-fifth of the territory is occupied; you can have exclusive rights to "The Automatic" and "The Air Seal" Vaults. They are by far the best sellers. Your investment is small; your profits good; your sales easy. In fact, you do no selling; it is all done for you. Write now for our FREE book telling how money is made in "The Automatic Sealing Vault" business. Write today.

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INDEPENDENCE IN SIX MONTHS WITH THIS MACHINE

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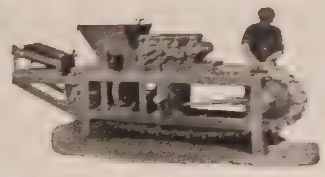

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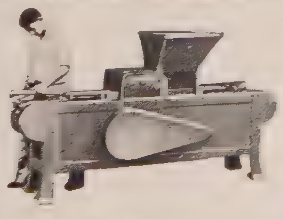
"The first DUNBRIK sold were for mantels. From these small orders our brick became known throughout this part of the country. While we have been filling orders as rapidly as possible, we are now over 600,000 brick behind and have arranged to run our plant on extra shift.

"Our DUNBRIK have been used in all buildings of any importance and at least 75% of the smaller buildings in our territory. The masons lay our brick at $1.50 per thousand less and the contractors tell us that our brick lay up better with less mortar and are cheaper in the wall. We have not had a single customer who is not pleased with our DUNBRIK or DUNSTONE bought from us and I might add that we are all highly pleased with what the DUNBRIK machine has done for us." Signed Tom Belk.

With America's greatest building market approaching and government finances available everywhere, DUNBRIK possibilities today offer outstanding opportunities for a reliable firm or individual in each territory. Investigate now. Send for book "4 Keys to Sucess."



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Here is a real honest-to-goodness concrete form material that will take punishment and like it. It is as permanent as solid lumber can be and far stronger than solid lumber can ever be. The plies are in effect wood-welded-to-wood and they cannot separate because the natural resin binder is absolutely insoluble in water.

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The Modern Concrete Form Material . . . .

Down go your costs and up goes efficiency. In the saving of labor, in stronger, more rigid forms, in ultra-smooth surfaces, Harboard SUPER Plycrete makes itself invaluable to 1935's contractor. All tests—compression, tensile, transverse, as well as water absorption and shear tests, find these amazingly strong panels able to withstand stress and strain without cracking or bulging, even though soaking wet. Study the possibilities of this modern plywood development in terms of your own gain.

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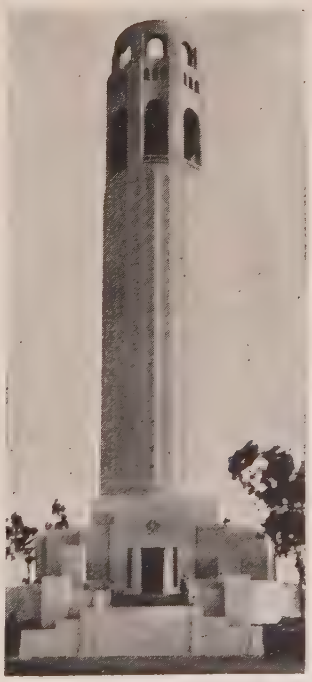

A radical departure in plywood making, developed by James V. Nevin, Ph.D., Ph.C., with exclusive Harbord patents. The plies are fused together with a natural resin-base bond under heat and tremendous pressure—HOT PREST FOR PERMANENCE. Waterproof and possessing unbelievable strength.

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Panels Hot-prest with Nature's Own Resin . .

New Books and Pamphlets

1934 Proceedings of A.S.T.M.

The Proceedings of the thirty-seventh annual meeting of the American Society for Testing Materials, Vol 34, 1934, have been published, as usual, in two volumes—Part I and Part II. Part I comprises the reports of the A.S.T.M. standing committees together with all new and revised tentative specifications and tests; Part II, the technical papers. Both parts together comprise some 2,260 pages.

Parts I and II are available in stiff paper cover at $5.50 each; in cloth at $6.00 each, and in half-leather at $7.00 each.

Final Report of International Congress

Final Report of the Congress of the International Association for Bridge and Structural Engineering. Published in the English, French and German languages by the General Secretariat of the International Association for Bridge and Structural Engineering, Zurich, Switzerland. Clothing binding, 745 pages. Price, 36 francs.

This Final Report, covering the first congress of this organization, held in Paris from May 19 to 25, 1932, was published in November, 1934. It contains discussions as well as original papers. The various engineering papers are printed in the language in which the author presented them, and in many cases translations are included.

Testing Cements

A Method for the Mechanical Testing of Cements is the title of an English translation of Bulletin No. 11 of the Institute for Technological Research (Instituto de Pesquisas Technologicas), located at Sao Paulo, Brazil. Copies of the translation as well as copies of the original bulletin may be obtained from the Institute.

In this 52-page bulletin the authors—A. F. Torres and Romulo de L. Romano—propose compressive strength tests on 1:3 cement mortars as the most reliable indicators of the concrete-making value of cements. This method of testing was employed in the series reported in this bulletin.

Cement and Concrete Reference Book

Cement and Concrete Reference Book, a 32-page booklet issued by the Portland Cement Association, 33 W. Grand Ave., Chicago, contains authentic information on this important industry.

Among the data included, the reader will find interesting information on highway maintenance costs, the use of concrete in airports, and on the diversion of motor taxes. Annual production and shipments of portland cement are given for the period from 1870 to 1933. Copies of this booklet may be obtained on request.

Concrete Construction in Coal Mines

Less Cost Per Ton with Concrete is the title of a new 32-page booklet issued by the Portland Cement Association, 33 W. Grand Ave., Chicago.

This booklet is the result of a survey of coal mine construction practice in four large coal-producing states. It describes the uses of concrete in and around coal mines and gives simple rules for making quality concrete. Copies may be obtained on request addressed to the Portland Cement Association.

ORGANIZATIONS

American Association of State Highway Officials; W. C. Markham, Executive Secretary, 1222-24 National Press Building, Washington, D. C.

American Chemical Society, Mills Building, Washington, D. C.

American Concrete Institute; Harvey Whipple, Secretary, 7400 Second Blvd., Detroit, Mich.

American Concrete Pipe Association; M. W. Loving, Secretary, 33 West Grand Ave., Chicago.

American Institute of Chemical Engineers, Bellevue Court Bldg., Philadelphia, Pa.

American Railway Engineering Association; E. H. Fritch, Secretary, 59 East Van Buren St., Chicago, Ill.

American Road Builders' Association; Chas. Upham, Engineer-Director, National Press Building, Washington, D. C.

American Society of Civil Engineers; Geo. T. Seabury, Secretary, 33 West Thirty-Ninth St., New York City.

American Society for Testing Materials; C. L. Warwick, Secretary-Treasurer, 260 S. Broad St., Philadelphia, Pa.

Associated General Contractors of America; E. J. Harding, Managing Director, 222 Munsey Bldg., Washington, D. C.

Building Officials Conference of America; Wm. F. Hurd, Secretary, Room 203, City Hall, Indianapolis, Ind.

Calcium Chloride Association, 4200 Penobscot Bldg., Detroit, Mich. R. A. Giddings, Secy.

Cast Stone Institute; C. G. Walker, Asst. Secy., 33 West Grand Ave., Chicago, Ill.

Cement Institute; H. C. Lundborg, General Manager, 11 East 44th St., New York City.

Concrete Reinforcing Steel Institute; R. W. Johnson, Secretary, 201 N. Wells St., Chicago, Ill.

Engineering Institute of Canada; R. J. Durley, Gen. Secy., 2050 Mansfield St., Montreal, Quebec.

Highway Research Board; Roy W. Crum, Director, 2101 Constitution Ave., Washington, D. C.

Joint Committee on Standard Specifications for Concrete and Reinforced Concrete; F. R. McMillan, Secretary, 33 West Grand Ave., Chicago.

National Board of Fire Underwriters; W. E. Mallalieu, General Manager, 85 John St., New York City.

National Cinder Concrete Products Association; Einar Christensen, President, 1600 Arch St., Philadelphia, Pa.

National Concrete Burial Vault Association; J. H. Stuart, Secretary-Treasurer, Bremen, Ohio.

National Concrete Masonry Association; Horace W. Bush, Secretary and Treasurer, 211 Edgemont Place, Teaneck, N. J.

National Crushed Stone Association; J. R. Boyd, Secretary, 449 Munsey Bldg., Washington, D. C.

National Highway Users Conference, Roy F. Britton, Director, National Press Bldg., Washington, D. C.

National Lime Association; Norman G. Hough, Secretary and Manager, 927 Fifteenth St., N. W., Washington, D. C.

National Ready-Mixed Concrete Association; V. P. Ahearn, Secretary, 545 Munsey Bldg., Washington, D. C.

National Sand and Gravel Association; V. P. Ahearn, Executive Secretary, 545 Munsey Bldg., Washington, D. C.

National Slag Association; H. J. Love, Secretary-Treasurer, Earle Building, Washington, D. C.

National Terrazzo and Mosaic Association; J. M. Fuhrman, Secretary-Treasurer, 524 Brook Street, Louisville, Ky.

New Jersey State Concrete Products Association; Horace W. Bush, President, Lyndhurst, N. J.

Portland Cement Association; Edward J. Mehren, President; William M. Kinney, General Manager, 33 West Grand Ave., Chicago.

Rail Steel Bar Association; H. P. Bigler, Engineering Secretary; Builders' Bldg., 228 N. La Salle St., Chicago, Ill.

Wire Reinforcement Institute; R. D. Bradbury, Director, National Press Bldg., Washington, D. C.

Wisconsin Concrete Products Manufacturers' Association, Inc.; L. E. Schwalbe, Secretary, Wauwatosa, Wis.

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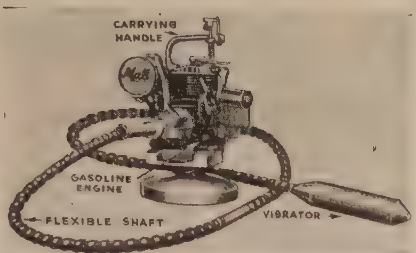

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And look—mold box liner plates for Anchor Strippers (to make round-cornered blocks) and necessary parts to convert Anchor Floor Type Tampers into Double Bar or 8-Drop type.

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How to Make and Sell Them

A 64-page booklet, entitled "How to Make and Sell Concrete Specialties," was published by the Concrete Publishing Company in 1928, and was distributed quite extensively throughout the concrete products industry.

Individual chapters cover the following subjects: (1) Analyzing the market for concrete specialties; (2) concrete burial vaults; (3) concrete septic tanks; (4) concrete fence posts; (5) concrete sills and lintels; (6) concrete silo staves; (7) concrete roofing tile; and (8) concrete floor tile.

A limited number of copies of the booklet, just made available, can again be offered to readers of "Concrete" while the supply lasts, at the reduced price of 50 cents a copy, which is half the publisher's price of $1.00.

Orders should be addressed to

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EQUIPMENT AND MATERIALS

POROUS DRAIN PIPE may be manufactured from any acceptable portland cement or special cement and the proper fine and coarse aggregates intimately mixed, properly molded and cured. As a result of the method of control and molding, a concrete unit is made which permits the transmittal of water through the wall of the pipe without sacrificing strength. Laboratory tests from a number of commercial and governmental laboratories give strength results in excess of that required for Extra Quality Drain Pipe A.S.T.M. C4-24 and with the added advantage that for properly designed work the cost of completed drainage ditches using Porous Drain Pipe is from 15 to 50 per cent lower than the commonly designed ditch with impervious wall pipe, according to the Smith company.

Section of Smith porous drain pipe

At the present time this concrete unit is being used in railroad track drainage and railroad underpass work, in playground and athletic fields, in mill construction drainage, by nationally known constructors in the construction of hospitals, research laboratories, etc., and by many architects in building construction of all types. In addition, Porous Drain Pipe is said to be applicable to the field of agricultural irrigation, and land drainage and reclamation. This pipe is said to have a dual personality—a concrete unit with the properties of either collecting or dispersing water, dependent upon the need.

Smith Porous Drain Pipe Corp., Pittsburgh, is contemplating licensing concrete product plants to produce this unit.

●

LIQUID COPPER — Announcement of the discovery of a method, whereby copper can be reduced to a liquid form and applied to any surface, has just been made by the Nichols Copper Company of Chicago.

After working in a secret laboratory for nearly eight years, two university graduate scientists have finally found a way to break copper down into an exceedingly fine non-crystalline form. Mixed with a special vehicle, also recently developed, the copper can now be applied as a liquid to form a protective coating over practically any surface, they say.

In the new form, the copper particles, so fine that they penetrate a 350-mesh screen, pack tightly together and remain in suspension in the carrier. When applied to the surface they form a virtual sheath of almost pure metal over the entire area, according to the company. Laboratory and field tests already have shown the high degree of resistance to acid and other forms of corrosion, characteristic of the material. It can be sprayed, dipped or applied with a brush and is suitable for both interior and exterior applications.

●

DELMAR suction hose is a new type of hose construction—a woven tubular reinforcement of strong cabled cotton cords and wire, making a very strong but light hose which will not collapse, according to the Electric Hose and Rubber Company, Wilmington, Delaware. Made in all sizes up to 4 in. inside diameter.

●

MAGNUS cement cleaner and renovator, manufactured by the Magnus Chemical Company, Garwood, N. J., is said to clean, bleach and harden cement floors and driveways.

Manufacturers' News

THE operating companies of Godfrey L. Cabot, Inc., held their Annual Safety Banquet on the night of February 2 at Crazy Hotel, Mineral Wells, Texas.

The safety contest this year was won by the Eliasville plant with a record of only 21 man hours lost due to accidents during 1934.

Godfrey L. Cabot, Inc., of Boston was represented by Thomas D. Cabot, Secretary and Treasurer, and Edmund Billings, Vice President. The feature of the evening was the presentation of the Safety Trophy.

●

P. & H. Model 750-LC dragline designed primarily for work on irrigation and drainage jobs where soft ground is encountered has been provided with "mud shoes."

Length of crawler has been increased to 15 feet 9¼ inches. Crawler shoes are 42 inches wide, resulting in a reduction of ground pressure to only 7.3 pounds per square inch.

●

JOSEPH T. RYERSON & SON, INC., is now completing an extension to its Milwaukee plant at 244 South 19th Street, which will almost double the former warehousing capacity of this plant.

Industrial Literature

UNIVERSAL Form Clamp Co., Chicago, is distributing pages 11, 12 and 13 for filing in the Universal Engineering Service Data Book.

Page 11 is a form for tunnel work, using plywood, Universal Spi-Ro-Loc clamps and form clamps. The inside form is built to a convenient length and moved on skid rails as the work progresses.

Page 12 shows a layout for seawalls and spillway sections, together with a practical method of tying down the forms.

Page 13 consists of details whereby a new superstructure is formed and poured as a saddle resting on the old deck and substructure of the bridge.

●

STRUCTURAL HIGHWAYS is the title of a new catalog recently published by the American Concrete Expansion Joint Co. of Chicago. The catalog deals with the subject of expansion and contraction of concrete roads in a thorough and practical manner.

Instruction Manual for Field Engineers, also published by the makers of Ace-Joints, contains directions for installing Ace-Joints for their men in the field.

●

MODERN SHOVELS for Today's Job is the title of a new bulletin—No. 3413—ready for distribution by The General Excavator Company of Marion, Ohio. This bulletin pictures and describes their new ½, ⅝, and ¾ yd. machines—the General (½ and ⅝ yd.) and the Invincible (⅝ and ¾yd.)—available in gasoline, diesel and electric power. Booms are interchangeable for shovel, pullshovel, skimmer, dragline, clamshell and crane operation.

Cement Mill Section of
Concrete

Vol. XLIII
No. 3

MARCH
1935

Mechanical Types of Dust Collectors Adapted to Cement Plants

Types of Dust Collectors—Some Cloth Filters and Centrifugal Collectors Described—Effect of Dust on Health of Workers

COLLECTION of dust has always constituted one of the most important and troublesome side issues in the design and operation of cement manufacturing plants. The desire to recover dust in this branch of industry is not due to the value of the dust, for as a general thing the cost of collecting exceeds the value of the product recovered. The desire is primarily that of increasing the efficiency of operations by removing the dust nuisance, thereby improving the working conditions for employees and reducing the damage to valuable machinery. When plants are located near towns or cities, the dust nuisance must be eliminated from the surrounding area.

Dust and Health

Formerly it was believed that dust originating in cement manufacturing plants was detrimental to the health of employees, this belief having been founded on the supposition that the inhalation of fine dust particles would lead to the development of serious respiratory and pulmonary diseases. In comparatively recent times this belief was proved to be wrong, partly through a series of tests conducted over a period of three years by the United States Public Health Service.

Minor Diseases

A report on the tests just mentioned appears in the *Cement Mill Edition* of CONCRETE, in the issues of April, 1930, pages 115-117, and May, 1930, pages 114-117. These tests, however, disclosed the fact that cement plant dust may cause minor respiratory trouble, diseases of the skin, the eyes and the ears, rheumatism, and impairment of the digestive system. In consequence, an additional reason exists for the removal of the dust nuisance, inasmuch as the development of these minor diseases may—and sometimes does—provide an opening which racketeering lawyers are only too eager to seize. Damage suits of this type invariably lead to harmful publicity, even if—as is usually the case—the cement company wins.

Finally, we have the further fact that the stone dust returned to the raw meal stream and the cement returned to the storage bins have some value.

Types of Dust Collectors

Every dust recovery problem has its own peculiarities, so that the type of dust collecting equipment best adapted to the conditions encountered in one plant is not necessarily the most efficient in another plant. Dust collecting installations may be grouped into the following three general types:

(1) Mechanical collectors such as cloth and screen filters, centrifugal collectors, the impact type, and settling chambers.
(2) Washers and sprays.
(3) Electrical precipitators.

Several installations of the first group will be described. Typical dust collectors of the cloth filter type are those designed and installed by the Allis-Chalmers Manufacturing Co. at the two plants of the Missouri Portland Cement Co. located at Prospect Hill and Sugar Creek, Mo. A part of the Prospect Hill installation is shown in Fig. 1.

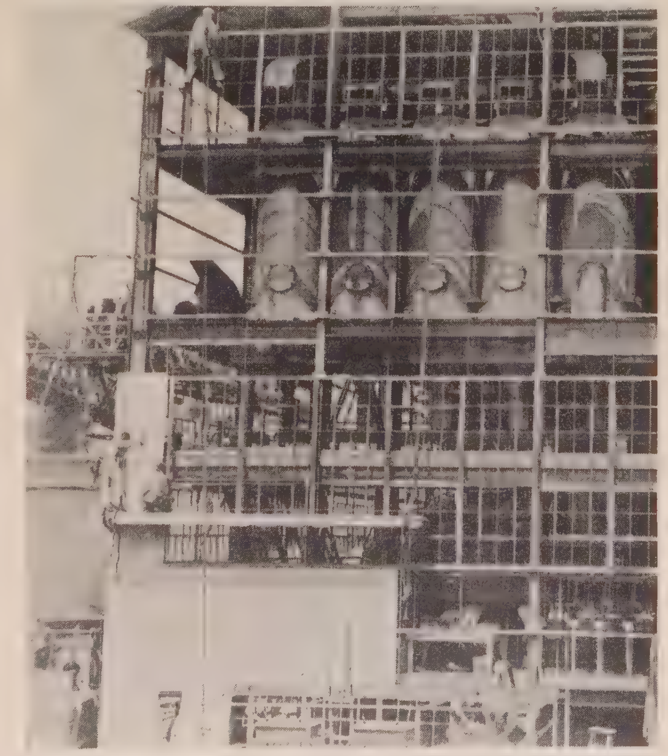

Fig. 1—Cloth filter dust collectors installed by the Allis-Chalmers Manufacturing Co. at the Prospect Hill plant of the Missouri Portland Cement Co.

The Allis-Chalmers Dust Collector

The Allis-Chalmers dust collector consists essentially of a series of annular compartments each containing twelve cloth bags that serve as the dust collecting medium. The bags consist of a special porous cloth that retains the dust inside the bags and allows the purified air to pass through into the compartment within which the bags are suspended.

This type has been found highly efficient throughout all parts of cement plants where the temperature and the moisture content of the dust-laden air are relatively low. These favorable conditions are found in the raw grinding department, in the finish grinding department, in the packing department, and in various other parts of the plant.

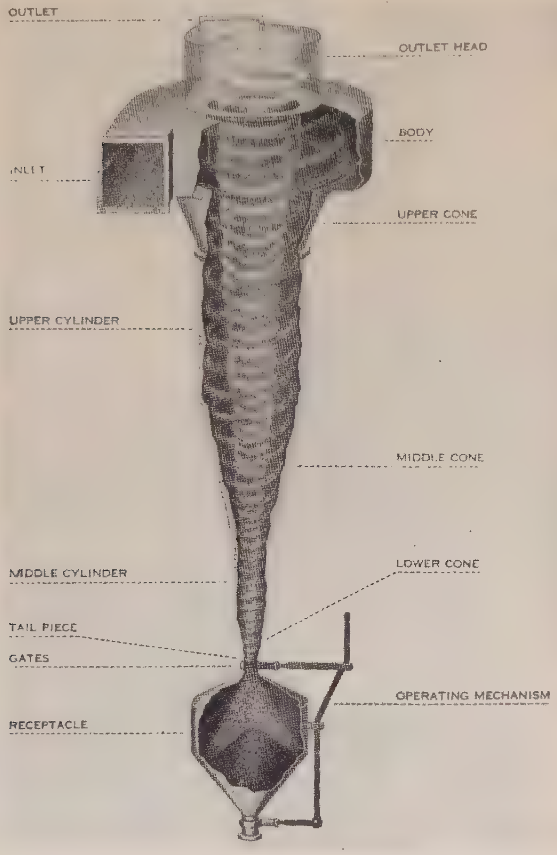

Fig. 2—Detail showing operation of centrifugal dust collectors installed at the Oglesby plant of the Marquette Cement Manufacturing Co.

For instance, at the Sugar Creek installation of the Allis-Chalmers filter a 5-compartment collector is hooked up with a compeb mill and two air separators, and the collector is also connected to all screw conveyors, bins, scoop housings and elevators in the raw grinding end of the plant. The raw material ground at this plant is limestone and shale.

Course of Air Currents

Each of the five compartments, with its twelve bags, provides 625 sq. ft. of filtering area, bringing the total to 3,125 sq. ft. During operation the dust-laden air enters near the bottom of the compartment and is compelled to make a turn in entering the open lower ends of the cloth bags. This sharp turn of the air current has a tendency to drop the heavier particles of dust into the hopper at the bottom of the compartment. While the dust is being collected the bags, which are closed at the top, are slack. The air entering the lower end of the bags passes through the cloth and out through a fan.

Operation of Shaking Device

An automatic shaking device operated by a 3-hp. electric motor is provided and is set to shake each compartment at intervals of five minutes, the separate compartments being shaken successively. By means of valves that control the mechanism, the air passing through the cloth bags is reversed in direction, thus cleaning the pores of the cloth. In the complete shaking cycle the air is at first held at equal pressure inside and outside the bags. With this balanced pressure prevailing, the shaking is continued for a short period. This shaking process consists of suddenly tightening the bags and then allowing them to slacken. This preliminary shaking during the short period when the air pressure inside and outside the bags is equalized has the effect of removing the dust that has accumulated on the inside face of the cloth. Then the valves controlling the air currents are reversed, creating a suction within the bags. At the same time fresh, clean air is admitted into the compartment, outside the bags, and the bags are again given several violent shakes. The counter-current of the air thus forced through the cloth walls of the bags from the outside to the inside, while the bags are being shaken, has the effect of cleaning out the pores of the cloth.

The Dust Reclaimed

During the two periods of the shaking cycle just described in detail, the bags are shaken continually, the released dust dropping into a hopper at the bottom of the compartment, from which it is fed to the mill stream and sent to the raw storage bins.

All operations of the 5-compartment dust collector at the Sugar Creek plant are controlled by means of cams and gears from one drive motor. Suction through the compeb mill and dust collector is maintained with a 30-hp. motor connected to a fan. An approximate volume of 8,000 cu. ft. of air per minute is being drawn through the compeb mill, the elevator housing and the sump housing. The result is a clean mill room that offers a pleasant contrast to the conditions formerly prevailing.

The installation at the Prospect Hill plant of the same cement manufacturing company is similar to the Sugar Creek plant in practically every detail, except that it consists of double the number of compartments—ten in all—five of which are shown in Fig. 1.

Centrifugal Type at Marquette Plant

The centrifugal type of mechanical dust collector is well typified by the five units at the Oglesby (Illinois) plant of the Marquette Cement Manufacturing Co. These units, known to the trade as the "Sirocco" dust collector, were built and installed by the American Blower Corp. This collector is practically the same as the one known in England under the name of the Davidson cyclone collector.

The five units installed in the Oglesby plant are hooked up with the waste heat boiler system that utilizes the heat of the kiln gases. Figure 2 is a sectional drawing of one of the units, so designed that dust-laden air or gases may either be blown through or drawn through by suction.

Operation of Centrifugal Collector

The operation of this dust collector may be understood from a careful study of Figure 2. The dust-laden kiln gas enters the volute-shaped scroll at the top of the unit, through the rectangular inlet. The air current, moving at a velocity of more than 30 ft. per second, enters this scroll tangentially, causing the air current to spin around in a path following the peripheral shape of the volute. Because of this spinning motion the dust particles, being heavier than the gas, are forced outward against the periphery.

As the air current moves downward through the unit, the radius of the unit decreases and the angular velocity of the spinning current increases. In consequence, the separating effect increases as the current descends. In the meantime, since the dust particles are forced outward against the periphery of the collector, borne along by the spinning air current, the cleaned gas forms a rarified vortex in the center of the collector and passes upward through the outlet.

Handling the Recovered Dust

Immediately above the dust outlet at the bottom, the base of the vortex is formed. A decided suction exists at this point. Here the dust particles drop into a sealed receptacle shown in the drawing (Fig. 2). In this receptacle the air pressure is negative, a condition which necessitates air-tightness in order to prevent the flow of air upward through the collector, and the consequent destruction of its efficiency.

From this air-tight receptacle at the bottom of the unit the recovered dust is conveyed through a pipe line to the dust storage bins and fed back into the kiln with the raw meal.

A European Mechanical Collector

A well-known European type of dust collector, known as the Beth filter, is shown in Fig. 3. In this unit the dust-laden air or gas is drawn by an exhauster through a number of cloth tubes, arranged in compartments, which retain the dust while the cleaned air is discharged to the atmosphere. The dust is periodically and automatically shaken off and at the same time blown off the filter tubes by a mechanical shaking gear and a separate positive supply of clean scavenging air.

The quantity and the pressure of the scavenging air current can be controlled, and thus adapted to the specific nature of the dust. When the gases are highly charged with moisture the scavenging air is preheated to prevent condensation in the casing and a moistening of the tubes. Internally this collector is arranged so that each compartment during the cleansing process will be isolated from the other compartments in operation.

While differing in external appearance, this unit utilizes many of the principles incorporated in the collector illustrated in Fig. 1.

Washers and Electric Precipitators

As to the second group of dust collectors mentioned at the beginning of this article—the washers and sprays—they are used to a limited extent in connection with cement kilns, but they have gained less favor than some other types.

Electrical precipitators constitute an extensive subject in themselves, and will therefore not be discussed in detail in this article. It will suffice to say that electrical precipitation is highly efficient—higher than that of the general run of mechanical collectors—but that the cost of the installation and the subsequent cost of operation are relatively high. The choice of this type of dust collection, therefore, involves the question of the degree of efficiency desired. Here, again, the answer to this question will differ with respect to different plants.

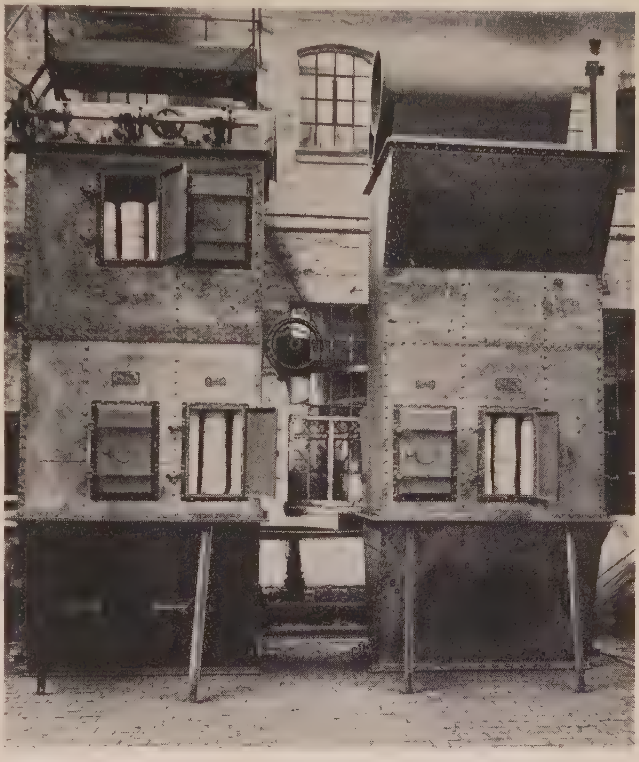

Fig. 3—Cloth filter dust collectors—a European type. Cloth bags may be seen through opened inspection doors

Probably the largest electric precipitator installation in the American cement industry is the one at the Buffington plant of the Universal Atlas Cement Co., described in detail in an illustrated article in the *Cement Mill Edition* of CONCRETE, June, 1931, pages 69 to 73.

Trinity Buys Two Vanderwerp Heat Recuperators

TWO Vanderwerp heat recuperators are now in course of manufacture for the Fort Worth plant of the Trinity Portland Cement Co., of which John L. Senior is president.

The heat recuperators, which are manufactured and installed by the Manitowoc Engineering Works, Manitowoc, Wis., will be hooked up with two rotary kilns each 11 ft. 3 in. in diameter and 250 ft. long. They will be similar in design, but considerably larger, than those installed early in 1934 for the Kosmos Portland Cement Co. The Trinity's installation will, in fact, be the largest Vanderwerp recuperators thus far installed in a cement plant.

Direct Determination of Alkalies in Portland Cement[a]

Requires Elimination of Only the Main Body of Silica by One Evaporation

By A. A. BERK[b] and P. S. ROLLER[c]

SODIUM and potassium in portland cement usually are estimated by weighing as the mixed chlorides, and then determining the potassium in the mixed chlorides as chloroplatinate or as perchlorate. It is necessary in this scheme to remove completely SiO_2, SO_3, MgO, CaO, Fe_2O_3, and Al_2O_3, to volatilize added ammonium salts and to precipitate added barium salts. Two procedures are employed for accomplishing this result, one involving initial high-temperature decomposition according to the J. Lawrence Smith method,[1] the other involving decomposition with HCl solution according to the usual methods for portland cement.[2] In either case the procedures are time-consuming and susceptible to error.

To obviate these difficulties a method of determination of the alkalies has been devised which requires only incomplete elimination of the silica. The potassium is determined by precipitation as chloroplatinate, and reduction of the latter to metallic Pt with Mg wire, as suggested by Hicks and Bailey.[3] The sodium is determined on a seperate aliquot by precipitating with zinc uranyl acetate on the basis of the procedure of Kolthoff and Barber.[4]

REAGENTS

Chloroplatinic acid:—2.75 per cent solution of $H_2PtCl_6.6H_2O$ in hydrochloric acid (1:10). (1 cc. equivalent to 0.005 gm. K_2O).

Uranyl zinc acetate:—Dissolve, with warming and stirring, 10 g. uranyl acetate ($2H_2O$) in a solution of 1.7 cc. glacial acetic acid in 53 cc. water, and 30 g. zinc acetate ($3H_2O$) in a solution of 0.9 cc. glacial acetic acid in 34 cc. water. Mix both solutions and allow to stand 24 hours. Filter off the precipitate of uranyl zinc sodium acetate derived from sodium in the reagents. When kept in pyrex glass the saturated solution does not become turbid after long standing.

Saturated ethyl alcohol:—95 per cent alcohol saturated with uranyl zinc sodium acetate.

Magnesium wire:—0.025 to 0.062 in. diameter. Should dissolve in HCl solution with no residue.

PROCEDURE

Two grams of portland cement are treated with 25 cc. HCl (1:1) in a platinum dish (porcelain or glass may be used, provided they are similarly used in the blank determination). Both gentle warming and agitation may be necessary to complete the decomposition. The dish is placed on the steam bath and the solution evaporated to complete dryness. The residue is heated to about 150 deg. C. for one-half to one hour. It is then broken down with a glass rod in the presence of 25 cc. of acetic acid (1:20). After digestion for ten minutes on the steam bath, the contents of the dish are filtered into a 100-cc. volumetric flask.

The residue, which is to be discarded, is washed 5 or more times with 5-cc. portions of hot water. After the flask containing filtrate and washings has cooled, its contents are made up to 100 cc. with distilled water.

A. Determination of potassium. A 75-cc. aliquot of the solution in the flask is pipetted into a 250-cc. beaker, 10 cc. of chloroplatinic acid solution added, and the whole evaporated first on a hot plate, and finally on a steam bath to incipient dryness. The soft residue is taken up with 20 cc. of 95 per cent alcohol, broken up with a flattened glass rod, and allowed to stand 20 to 40 minutes. It is filtered through a coarse filter equivalent to Whatman No. 4. A faint turbidity may appear in the filtrate, in which case the filtrate may be obtained clear by passing it through a finer paper (No. 42 Whatman or its equivalent) as it drops from the funnel of the coarse filter. The filtered residue (or residues) is washed 4 times with alcohol (total not to exceed 75 cc.) to remove the excess chloroplatinic acid. The potassium chloroplatinate is contained in the residue on the filter paper and is dissolved out by washing the residue on the filter with 100 cc. of hot water. The extracted residue is discarded. The solution in a beaker is made up to 150 cc. with water, and 1 cc. of concentrated HCl and 2 pieces of Mg wire each weighing about 60 mg. are added. The mixture is allowed to stand until the solution has cleared completely, either one or two hours on the steam bath or overnight at room temperature.

The platinum is coagulated with 3 cc. concentrated HCl and filtered, after complete solution of the Mg, onto a quantitative filter paper equivalent to Whatman No. 40. It is washed free of HCl with 100 cc. of hot wash water, ignited and weighed. Grams $K_2O = 0.4825$ gm. Pt.

B. Determination of Sodium. A 20-cc. aliquot of the solution in the flask is concentrated to 1 cc. in a small evaporating dish. To determine the amount a comparison dish containing 1 cc. of liquid may be used. At least 10 times as much uranyl zinc acetate solution, or about 10 cc., are added, with stirring, to the concentrated solution, and the mixture is allowed to stand 45 minutes or more. The precipitate is filtered into a previously weighed small fritted glass or Gooch filter. It is washed 6 times with 2-cc. portions of uranyl zinc acetate solution, 5 times with 2-cc. portions of saturated 95 per cent alcohol, and finally with 15 cc. of ether. The precipitate in the crucible is then air-dried, and weighed at 20-minute intervals to constant weight as $(UO_2)_3ZnNa(CH_3COO)_9.6H_2O$. Grams Na_2O = 0.0215 gm. uranyl zinc sodium acetate.

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[a] Published by permission of the Director, U. S. Bureau of Mines (Not subject to copyright).

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C. Blank. To correct for K_2O and Na_2O present in reagents and derived from vessels, a blank should be run occasionally under the same conditions as for the regular determination. The magnitude of the blank found here averaged 1.2 mg. Pt and 0.4 mg. uranyl zinc sodium acetate.

ACCURACY OF RESULTS

The results of duplicate determinations on several cements are given in Table 1.

TABLE 1—DETERMINATION OF K_2O AND Na_2O IN DIFFERENT CEMENTS

K_2O, per cent			Na_2O, per cent		
0.58	0.58		0.37	0.32	
0.47	0.47		0.27	0.27	
0.69	0.78	0.76	(0.63)	0.51	0.50
0.45	0.44		0.54	0.51	
0.97	0.99		(0.64)	0.29	0.29
0.92	0.88	0.89	0.53	0.50	
0.46	0.45		0.30	0.30	
0.63	0.64		0.23	0.22	
0.75	0.75		0.54	0.54	
0.42	0.43		0.26	0.24	
0.63	0.63		0.23	0.22	
0.61	0.61		0.48	0.47	
0.76	0.76		0.23	0.23	

A total of 56 determinations of K_2O and Na_2O were made, of which two determinations of Na_2O (in parentheses) were omitted due to excessive deviation. The average mean deviation in the percentage is for K_2O 0.01 per cent and for Na_2O 0.01 per cent.

In order to determine the absolute accuracy of the method, known amounts of KCl and NaCl were added to the cement solution prior to evaporation to remove the silica. The results are given in Table 2, which shows that the method is one of absolute as well as relative accuracy.

TABLE 2—DETERMINATION OF ABSOLUTE ACCURACY

	K_2O, per cent		Na_2O, per cent	
	Determined	Calculated	Determined	Calculated
Original cement	0.64	——	0.33	——
After addition 1	0.77	0.80	0.48	0.46
After addition 2	0.95	0.96	0.59	0.59

Summary. A method of direct determination of K_2O and of Na_2O in portland cement is described, according to which it is necessary to eliminate only the main body of silica by one evaporation. Data on the relative and absolute accuracy of the method are given.

References:—
1. Meade, Portland Cement, Chemical Pub. Co. (1926).
2. Burchartz, Zement 20, 987 (1931).
3. Hicks and Bailey, U. S. Geological Survey Bull. 660B (1917).
4. Kolthoff and Barber, J. Am. Chem. Soc. 50, 1625 (1928).

Masonry, Natural and Puzzolan Cements in 1933

Shipments Only 20 Per Cent of Peak Year—Product of Thirteen Plants Included

A REPORT issued by the United States Bureau of Mines discloses figures on hydraulic cements other than portland cement—which include natural and puzzolan-cements and masonry cements of the natural cement class—produced in the United States in 1933 amounted to 466,632 bbl., which represents an increase of 2.2 per cent in comparison with 1932. In 1933 there were shipped from the mills 432,415 bbl. of these cements, valued at $571,648, a decrease of 17.6 per cent in quantity and of 17.9 per cent in gross value as compared with 1932. Stocks at the mills increased and were 22.8 per cent higher at the end of 1933 than at the end of 1932. The average factory value per barrel of the cement shipped from the mills was $1.32 in 1933 and $1.33 in 1932.

The statistics in 1933 represent the output of 13 plants located as follows: One each in Illinois, Indiana, Kansas, Kentucky, Minnesota, Ohio, and Wisconsin; and two each in Alabama, New York, and Pennsylvania.

MASONRY, NATURAL, AND PUZZOLAN CEMENTS PRODUCED, SHIPPED AND IN STOCK IN THE UNITED STATES, 1932 AND 1933

Year	Active plants	Production Barrels	Shipments Barrels	Shipments Value	Stocks (Dec. 31) Barrels
1932	15	456,785	524,844	$696,474	*150,164
1933	13	466,632	432,415	571,648	184,381

*Revised.

Similar statistics for the years 1925 to 1931, inclusive, will be found in the September (1932) issue of CONCRETE, page 44.

Recounting Michigan's Costly Experience with State-Owned Cement Plant

(From the *New Orleans States*, October 24, 1934)

THE state of Michigan recently had a rather disastrous experience in an experiment in public ownership. It was persuaded to undertake the manufacture of cement for use on its public works. The people were promised that there would be a substantial saving in state spendings.

So the state bought a plant already in operation and paid $500,000 for it, though private manufacturers said it was not worth more than $90,000. For new machinery and other improvements $790,000 was expended. The capital investment represented practically $1,300,000. Now the plant has been junked and Michigan has pocketed a loss of well over $1,000,000.

Poor shipping facilities and lack of adequate raw materials did not discourage the backers of the scheme. That is evidenced by the fact that when the mill was closed, after the Legislature in 1931 ordered it to be dismantled or sold by June, 1934, the state employees continued to draw pay. A year later there were still 19 on the pay roll with salaries aggregating $40,000 a year.

That decided the state to bring matters to a head. It decided that it could buy its cement cheaper than it could make it, and asked for bids for the purchase of its plant. It received an offer of $70,000, but had to reject this as an incompetent bid. Last June, junk dealers offered $35,000 for salvage on the plant and a private company paid $20,000 for the remaining unground clinker. So after having spent probably $1,500,000 or more Michigan gets back only $55,000 on its investment.

Portland Cement and Sulfuric Acid From Gypsum Anhydrite

Possibilities in Exploitation of Natural Deposits of Sulfates—One of Four Processes Described in Detail—Either Portland or Slag-Portland Cements Obtained

By **DR. PETER P. BUDNIKOFF**
Professor, Laboratory of Silicate Technology, Institute of Chemical Technology, Charkoff, U. S. S. R.

The December (1934) *issue of the Cement Mill Edition of* CONCRETE, *pages* 36 *to* 38, *contains an article by this author on "The Chemistry and Manufacture of Gypsum-Anhydrite Cement."—Editor.*

THE problem of obtaining portland cement from a mixture of gypsum or anhydrite with clay, with the simultaneous obtaining of sulfuric acid, acquired actuality in Germany during the World War. The chief impulse to the practical realization of this result was given by the absence of sufficient deposits of pyrites in Germany.

At present the requirements for the manufacture of sulfuric acid are met principally by pyrites, concentrates of non-ferrous ores, gas-cleaning masses from gas works, gases from metallurgical works, etc. On the other hand, there is a possibility of obtaining very great quantities of sulfuric acid from natural raw materials that are found in the form of sulfates—anhydrite, gypsum, sodium sulfates, etc.—that await their utilization in the production of sulfur and sulfuric acid.

Four Practical Methods Available

It suffices to point out that gypsum and anhydrite contain 18 to 23 per cent and sodium sulphate 22 to 25 per cent sulfur. The United States possess numerous and large deposits of this raw material, especially gypsum and anhydrite.

The use of gypsum and anhydrite for this purpose can have a practical significance only if utilized in such a way as to obtain simultaneously cement and sulfuric acid.

The following four methods of thus utilizing gypsum and anhydrite can be of practical importance:

(1) Thermal decomposition of sulfate and obtaining portland cement or slag portland cement.

(2) Decomposition of lime sulfate by introducing it into fused blast furnace slag; the sulfurous gas that becomes isolated is being worked over to sulfuric acid or sulfur and the slag, after granulation, is used for the production of clinkerless cement.

(3) Conversion of lime sulfate to ammonia sulfate by action of ammonia and carbon dioxide in an aqueous medium; the calcium carbonate obtained as a by-product can be worked over to portland cement.

(4) Conversion of calcium sulfate to ammonia sulfate by action of ammonia and carbon dioxide on a mixture of gypsum (or anhydrite) and clay in an aqueous medium; the ammonia sulfate obtained in the process is separated by filtration and the thick mass consisting of a mixture of clay (or slag) and calcium carbonate is being worked over to portland cement.

Without dwelling on various other possibilities of using gypsum or anhydrite for the production of sulfuric acid or sulfur, this article will be confined to the first method.

Theoretical Considerations

Investigations have demonstrated that the dissociation of calcium sulfate takes place approximately in the following way: from 800 to 1,000 deg. C. it is very inconsiderable—about 0.51 per cent; it increases as the temperature continues to rise and attains the amount of 2.3 per cent at 1,200 deg. C.; 4.1 per cent at 1,300 deg.; while at 1,375 deg. C. occurs a nearly complete decomposition of $CaSO_4$ in the fused mass. The reaction that takes place can be expressed by the following equation:

$$CaSO_4 = CaO + SO_2 + O - 116.86 \text{ cal.} \quad \ldots\ldots \quad (1)$$

From this it can be seen that the dissociation of one gram molecule of $CaSO_4$ requires 116.86 cal. But in a reducing medium the same process goes on much quicker and with a smaller expenditure of fuel, in accordance with the following equation:

$$CaSO_4 + C = CaO + SO_2 + CO - 87.36 \text{ cal.} \quad \ldots\ldots \quad (2)$$

On the other hand, at about 1,000 deg. C., besides the reactions shown, there occurs a reaction of reduction of sulfate in accordance with the following equations:

$$CaSO_4 + C = CaO + SO_2 + CO$$
$$CaSO_4 + 2C = CaS + 2CO_2$$
$$CaSO_4 + 3C = CaS + CO_2 + 2CO$$

By summing up these reactions we obtain—

$$3CaSO_4 + 6C = CaO + 2CAS + SO_2 + 3CO_2 + 3CO \quad \ldots \quad (3)$$

That is, three molecules of $CaSO_4$ require 6C, or one molecule of $CaSO_4$ requires 2C.

But to avoid too quick a reduction and the formation of a large quantity of CaS, which contributes largely to the fusion of the mass instead of its sintering (this being undesirable because it can lead to a high percentage of CaS in the portland cement clinker), the writer recommends taking half the theoretical quantity of coal.

In the process of decomposition of $CaSO_4$ the basic sulfate $CaSO_4.CaO$ is being partly formed, because its fusion temperature is much lower than the temperature of dissociation of gypsum. When obtaining portland cement clinker, this can also lead to an abnormal phenomenon if the process is conducted without the necessary precautions; that is, it may lead to the fusion of the mass instead of sintering, resulting in a surplus quantity of $CaSO_4$ in the finished portland cement and consequent irregularity in volume change in the cement.

Formation of Cement Clinker

The process of forming portland cement clinker and isolating SO_2 from the mixture of gypsum and clay meets with greater difficulties because the interval between the temperature of dissociation of $CaSO_4$ and the fusion temperature is quite insignificant.

The free lime that was formed in the process of reduction and dissociation of calcium sulfate combines with the components of clay and forms $CaO.Al_2O_3$ and $CaO.SiO_2$. According to Marshall, at the temperature of 1,273 deg. C. a reaction can occur between $CaSO_4$ and the free SO_2 of the clay, according to the equation:

$$2CaSO_4 + 2SiO_2 = 2CaO.SiO_2 + 2SO_2 + O_2 \quad . . . . (4)$$

As regards the reaction between $Al_2O_3.2SiO_2$ and $CaSO_4$, it occurs at about 1,130 deg. C., according to the same author.

The CaS that was formed in the process of reduction of calcium sulfate can react also with $CaSO_4$ and $CaO.SiO_2$, according to the equations:

$$CaSO_4+CaS+O_2=2CaO+2SO_2 \quad . . . . (5)$$

$$CaS+3CaSO_4+4CaO.SiO_2=4Ca_2SiO_4+4SO_2 \quad . . . . (6)$$

The presence of admixtures of Fe_2O_3 and FeO in the clay accelerates considerably the process of decomposition of $CaSO_4$. The SiO_2 reacts with FeO and CaO and forms $FeO.SiO_2$ (melting point of 1,150 deg. C.) and $3FeO.SiO_2 + CaO.SiO_2$ (melting point of 1,030 deg. C.). On the other hand, at about 1,250 deg. C. occurs the formation of $2CaO.Fe_2O_3$. The iron compounds that have been formed contribute catalytically toward obtaining $3CaO.SiO_2$, the quantity of which increases in accordance with the rise of temperature.

The possibility of the formation of CO_2 in the flue gases issuing from the kiln, creating a condition that is detrimental to the contact oxidation of SO_2 to SO_3, must also be taken into consideration. The reaction of forming CO goes on if CO is present in the flue gases, thus:

$$SO_2 + 3CO \rightleftarrows 2CO_2 + COS \quad . . . . . . (7)$$

Raw Materials

Gypsum and clay from Artemowsk were taken as initial raw materials. Table 1 shows data obtained from an investigation of these raw materials.

TABLE 1—COMPOSITION OF RAW MATERIALS

	Percentage of Separate Compounds						
Material	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Loss on ignition
Clay	63.76	18.0	6.40	3.04	0.25	1.76	6.82
Gypsum, $CaSO_4.2H_2O$	0.78	0.40	0.56	32.31	0.20	45.29	20.45
Anhydrite (gypsum burned at 600 deg. C.)	0.98	0.50	0.71	40.62	0.25	56.94	--
Coke waste	3.78	5.04		1.16	0.15	-------	89.82

The composition of the mixture of raw material, expressed in percentage, is shown in Table 2.

TABLE 2—COMPOSITION OF MIXTURE, IN PERCENTAGE

	Our data	German data
Clay	15.52	18
Anhydrous $CaSO_4$	77.60	75
Coke waste	6.38	7
	99.50	100

The addition of coke waste* to the mixture of clay and gypsum was made in a quantity corresponding to half the quantity needed theoretically according to the reaction shown. The gypsum was preliminarily burned in an electric furnace during one hour at 600 deg. C., and the clay was dried in a drying chamber at 110 deg. The mixture of clay, gypsum and coke waste was ground to a fineness that left no residue on the 900-mesh sieve (76 meshes per lin. in.), and a residue of 8 per cent on the 4,900-mesh sieve (178 meshes per lin. in.).

The mass obtained had a uniform moisture content of 7 to 8 per cent. Briquettes made from this mass were subjected to fractional burning in a cryptol Didier furnace—that is, first at 1,200 deg. C. for 2 hours, after which the temperature was gradually increased to 1,420 deg.

Lowering the $CaSO_4$ Content

The fractionated method of burning had the effect of avoiding fusion of the mass and lowering the quantity of $CaSO_4$ in the clinker obtained. For practical reasons, with the purpose of lengthening the time period during which the mass remains in the zone of maximum dissociation of $CaSO_4$, the production of portland cement from a mixture of gypsum and clay is preferably to be conducted in a rotary kiln with an enlarged zone. This will also increase the productive capacity of the plant.

TABLE 3—RAPIDITY OF DISSOCIATION OF $CaSO_4$

Burning temperature, deg. C.	Time of burning	Per cent of residual SO_3
In the dry mixture	----------	44.2
1,000	10 min.	42.3
1,200	10 min.	37.6
1,200	30 min.	32.5
1,200	1 hour	28.9
1,200	2 hours	22.4
1,300	1 hour	16.9
1,300	2 hours	8.9

Table 3 presents data obtained in the investigation of the rapidity of dissociation of $CaSO_4$ in the mass for cement production (whose composition was shown above) at different temperatures under laboratory conditions (in a Didier furnace). Table 4 shows the analysis of the clinker obtained.

TABLE 4—ANALYSIS OF CLINKER OBTAINED, EXPRESSED IN PERCENTAGE

Silica (SiO_2)	21.50
Alumina (Al_2O_3)	6.40
Iron oxide (Fe_2O_3)	3.10
Lime (CaO)	65.40
Magnesia (MgO)	0.40
Sulfuric anhydride (SO_3)	3.00
Calcium sulfide (CaS)	0.20
	100.00

The hydraulic modulus of the cement was 2.11; the silica modulus, 2.27; extent of saturation according to Kühl, 0.897; coefficient of saturation according to W. A. Kind, 0.841.

Microscopic Structure of Cement

A thin section of the portland cement clinker obtained was made, the microstructure of this section being shown in Fig. 1. From an inspection of a number of thin sections the following observations are made:

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*A part of the coke waste needed for reduction of calcium sulfate can be, presumably, replaced by coal pyrites that contain up to 15 to 20 per cent of carbon and 27 to 39 per cent of sulfur. This provides the possibility of enriching somewhat the SO_2 issuing from the kiln and to use clays with a smaller iron content, because it will enter the mass from the roasted pyrites obtained in the process of burning pyrites. Of course it will be necessary in this case to make a corresponding change in the quantity of air of combustion entering the kiln.

The ground base of the clinker consists of very fine crystalline grains, whose diameters can be measured by thousandths of a millimeter, and of an isotropic deep brown formless matter. These fine grains penetrate the deep brown matter, which forms thin strips between grains and plays the part of cement for the grains. The small grains that enter into the composition of the base are very fine, of irregular form, and possess very indistinct outlines. The principal mass of these grains possesses a brown coloring of different shades, with a bright interferential coloring. In many of them one may observe also some transparent grains with a low grayish-white polarization coloring. It seems that the first kind of brownish grains belong to belite, and the second to alite.

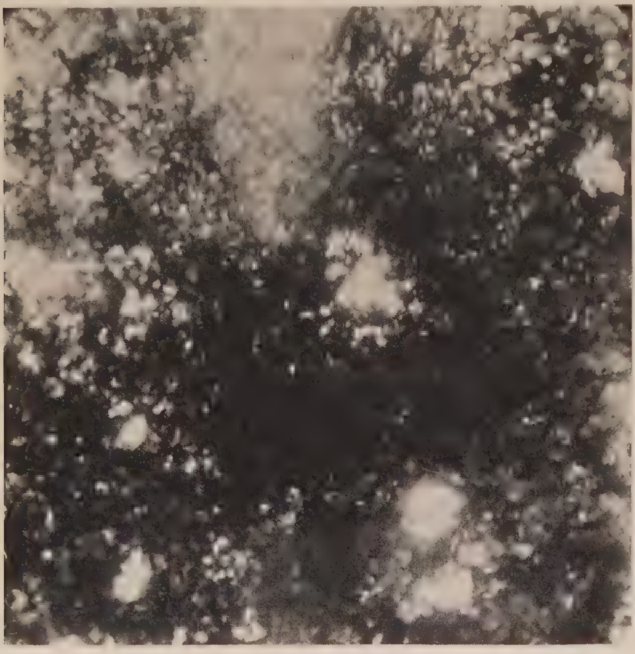


Fig. 1—Thin microscopic section of clinker from a mixture of clay plus $CaSO_4$

Chemical Analysis

The clinker was ground in a laboratory ball mill with various additions—that is, with $CaSO_4.2H_2O$, with $CaSO_4.\frac{1}{2}H_2O$, and with granulated basic blast-furnace slag. The chemical analyses of these materials will be found in Table 5.

TABLE 5—CHEMICAL ANALYSES OF ADDITIONS

	$CaSO_4.2H_2O$	$CaSO_4.\frac{1}{2}H_2O$	Basic blast-furnace slag
Silica (SiO_2)	0.43	0.51	33.26
Alumina (Al_2O_3)	0.44		9.59
		1.10	
Iron oxide (Fe_2O_3)	0.48		0.93
Lime (CaO)	32.34	38.61	50.71
Magnesia (MgO)	0.26	0.31	1.19
Sulfuric anhydride (SO_3)	45.31	53.76	(S) 2.90
Water (H_2O)	20.75	5.3	
Manganous oxide (MnO)	....	....	1.24

The experiment made with the addition of semihydrate was suggested by the following considerations: It is known that clinker, when ground with gypsum in a laboratory ball mill, produces a cement that differs from cement obtained from the same clinker and gypsum rock ($CaSO_4.2H_2O$) in a plant ball mill. Usually cement obtained in a laboratory mill requires more gypsum, its mechanical strength often being lower than that of the cement obtained at the plant. This can be explained by the fact that in the plant mill the temperature rises to somewhere from 120 to 200 deg. C., the bihydrate gypsum partly going over to semihydrate. In the laboratory mill this situation will, of course, not occur. Furthermore, bihydrate gypsum does not dissolve as quickly as semihydrate, and this leads to the difference in time of setting and in the mechanical strength of the cement.

Physical Test Data

Table 6 shows the test data obtained from the various cements.

TABLE 6—TEST DATA* OBTAINED FROM THE VARIOUS CEMENTS

Compositions	Per cent passing sieve 900 meshes per sq. cm.*	4,900 meshes per sq. cm.*	Crushing strength, lb. per sq. in. 7 days	28 days	Volume change
(1) Clinker 98 per cent; gypsum bihydrate, 2 per cent	98.8	85.2	2,915	4,695	plus
(2) Clinker 98 per cent; gypsum bihydrate, 2 per cent	98.7	85.7	3.555	4.625	plus
(3) Clinker 30 per cent; basic slag 68 per cent; gypsum bihydrate 2 per cent	98.5	84.4	2,845	3,770	plus
(4) Clinker 30 per cent; basic slag 68 per cent; gypsum bihydrate 2 per cent	98.6	84.8	2,560	2,985	plus
(5) Clinker 70 per cent; basic slag 28 per cent; gypsum bihydrate 2 per cent	97.9	83.6	2.845	3,980	plus
(6) Clinker 70 per cent; basic slag 28 per cent; gypsum bihydrate 2 per cent	98.3	84.1	1,670	2,420	plus
(7) Basic slag 100 per cent	99.2	88.7	....	400	minus

*Sieves of 900 and 4.900 meshes per sq. cm. are equivalent, respectively, to 76 and 178 meshes per lin. in.

In slag cements to which semihydrate was added instead of bihydrate, the mechanical strength of the cement obtained was lower. Portland cement demonstrated the reverse phenomenon; that is, the mechanical strength during the early hardening period was increased when semihydrate was added instead of bihydrate.

On the basis of the results obtained from the investigation the conclusion may be drawn that from a mixture of gypsum (anhydrite) and clay, portland cement and slag cement of normal qualities may be obtained.

When obtaining sulfuric acid and portland cement clinker from gypsum (anhydrite) this should be worked up to slag-portland cement. This is suggested from the fact that granulated basic blast-furnace slag will compensate the possible defects of the clinker. Our investigations demonstrated that slag-portland cements may be allowed to have a higher percentage of $CaSO_4$, because in slag there is an insufficient content of lime. Furthermore, the presence of CaS in slag cements is not dangerous. As demonstrated by our investigations, calcium sulfide enhances the activity of slag and increases the mechanical strength of the finished cement.

(To be continued.)

◆ EDITORIAL ◆

The Race Toward Modernization

Cement manufacturers clearly are working toward lowering their operating costs, for in this direction alone can they see the possibility of widening the margin between operating costs and selling price.

For instance, a plant in Texas has just placed an order for two clinker-heat recuperators to be hooked up with two large kilns. The results will include reduced fuel and grinding costs as the principal advantages, and an appreciable amount will be shaved off the cost of manufacture.

A plant in Missouri is having a modern type of calcinators installed, and a Southern plant has ordered modern dust collectors of sufficient capacity to produce clean air, thereby increasing the efficiency of workmen and reducing the wear on moving machinery. Here, again, the operating costs should be at least slightly reduced because of the improved working conditions, the longer life of mechanical equipment, and the recovery of the portion of the product that formerly was wasted in the form of dust.

And thus the story runs—shaving off a few cents per barrel here and a fraction of a cent there, always with the view of meeting competition by keeping a few jumps ahead of the field in this race toward modernization.

And let no one mistake the signs of the times—this race will grow hotter as the present year advances.

X

Political Cement Plants Again

As long as we have politicians and legislatures we shall, no doubt, have agitators demanding state-owned cement manufacturing plants.

The latest of these demands comes from Kansas, where a state representative has introduced a bill directing the state to build and operate a cement plant, and to supply the state highway department with this cement "at cost."

This last-named provision might turn out to be an unintentional joker, for if the highway department were required to pay a price that represented the real cost of manufacture, it might be paying a stiff price. That has been the experience of the state of Michigan and the city of Los Angeles. In the light of their experience it is hardly conceivable that a state-owned and state-operated plant could produce portland cement at a cost below the price at which the six cement plants in Kansas are now offering their product to the state.

But such reasoning means nothing to a politician. Little is he concerned with the fact that Michigan's cement plant cost the taxpayers of that state more than a million dollars, and that the plant is now being sold for junk after having served for a decade as a political football. Los Angeles, too, was glad to get rid of its cement plant after steadily losing money over a period of years and producing cement at a cost far above the mill price quoted by privately-owned plants that were operated by cement men.

According to Kansas newspapers, this particular politician will not get very far with his bill. He has introduced similar bills in previous sessions of the state legislature, but his proposed measures received scant consideration from his fellow law-makers.

Perhaps this politician does not expect his bill to get anywhere. Perhaps his primary purpose is that of making an impression on the folks back in the home county. At any rate, it would seem that cement manufacturers have little cause for worry.

Puzzolan Cements

At the annual meeting of the American Concrete Institute, recently held in New York, P. H. Bates, president of the Institute, warned manufacturers of portland cement not to go out of their way to oppose the introduction and use of puzzolan-portland cements.

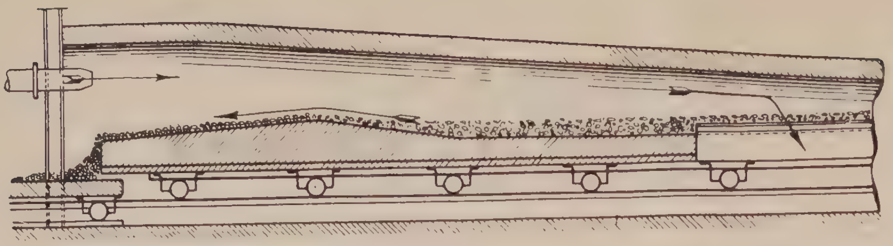
Puzzolanic cements, he said, have a definite place in construction and they have come to stay, regardless of all opposition.

Cement manufacturers, on their part, do have good reason to feel concerned at the host of special-use cements that are being proposed. Mr. Bates, himself, may have contributed something to this trend when, several years ago, he proposed six or seven types of special-use cements in a paper presented before the American Society for Testing Materials.

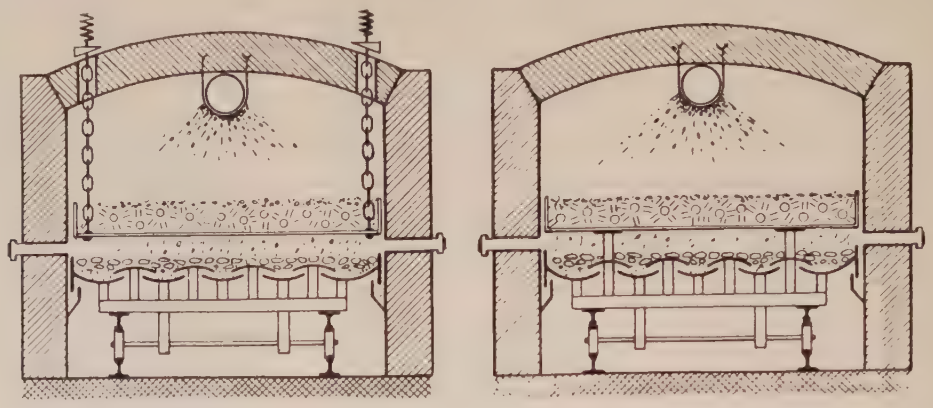
Manufacturers of cement feel—and rightly so—that the special properties demanded can be met with two or three special-use cements instead of six or seven. One cement, they say, may contain several special properties.

In Europe the German iron-portland and slag-portland cements have long been in use for concrete construction in or near sea-water. The former is an intimately-ground mixture of 70 per cent of portland cement clinker and 30 per cent of granulated blast-furnace slag. The latter is a similar mixture with the percentages reversed.

Whether or not blast-furnace slag is a true puzzolanic material, the results obtained in Germany, and to a lesser extent in England and the United States, have demonstrated that its qualities are similar. The place for puzzolan-portland cement in this country lies not only in sea-water construction, but in regions affected by alkali waters.



Left: Figure 1—Compound flame furnace



Right: Figure 2—Vibratory grate for use in wet process

Compound Flame Furnace Applied to Burning of Cement

Exit Gases Have Low Temperature—Material Passed Along on Vibratory Grate—Construction of Kiln Described

By N. C. KYRIACOU
(In October, 1934, issue of *Cement and Cement Manufacture*, London)

THE flame furnace enables the maximum amount of heat to be produced in the minimum time and at the highest temperatures obtainable in practice. If, in addition, the installation of a powerful plant capable of high production rates is included, the importance of the flame furnace is seen. For instance, smelting furnaces recently installed in Rhodesia are of the flame furnace type, 7.62 metres (25 ft.) wide by 30.5 metres (100 ft.) long; they are equipped with four burners, and the fuel consumption exceeds 100 tons of coal dust per day. Nevertheless, the flame furnace of present-day design is inefficient, chiefly due to the high temperature of the gases which as they leave the furnace carry with them 30 per cent of the heat produced. Several remedies have been proposed, the addition to the flame furnace of heat-recovery boilers being the system most generally employed.

Improving the Efficiency

The flame furnace, owing to the hung construction of its main arch, may be increased in size now that adequate refraction is possible by the use of a material such as radex, sillimanite, or bricks of cast bauxite, simensite, etc. The reduction in heat production, and particularly the degree of temperature obtained, leaving out of consideration ideal conditions of combustion without excess fuel consumption, are entirely dependent on pre-heating the air for combustion purposes and developing the flame as fully as possible. Thus if air at 0 deg. C. is used the temperature of combustion is merely 1,600 deg. C., whereas if the air is pre-heated to 200, 400 or 600 deg. C., this temperature may reach 1,735, 1,875 or 2,015 deg. C., respectively. The importance of the drop in heat production is well illustrated in the example given by Rosin. To melt chromium and sulphur requires the same amount of heat, approximately 200 calories per kilogram, but it is only possible to obtain the same effect with the two materials if allowance be made for a difference of 70 per cent, due to the fact that the melting point of chromium is one of the highest known, whereas the low melting point of sulphur enables the entire heat potential to be used.

Heat Transmission by Radiation

The transmission of heat by the flame furnace takes place by radiation and convection. The first process is by far the more important. Radiant heat is directed by the flame directly on to the material to be treated and also into the gas-filled atmosphere and on to the refractory walls of the furnace which throw back the heat received.

Heat transmission by radiation increases with the difference of the fourth power of the absolute temperature. A rise in temperature of the medium results in considerable heat radiation. Thus at 200 deg. C. the heat radiation from a black substance may be estimated at 2.4×10^3 calories per square metre per hour; at 1,000 deg. C. this figure rises to 125×10^3 calories per square metre per hour, while at 2,000 deg. C. a radiation of 490×10^3 calories per square metre per hour is attained.

Heat Transmission by Convection

Heat transmission by convection is governed by entirely different laws. In this case it is necessary for the gases to be kept in close contact with the material to be treated, and the gases must have a very high kinetic velocity. For instance, if we consider the first three-fourths of the length of an ordinary cement rotary kiln 100 metres long and which functions under the influence of heat transmitted by convection, the slurry may travel as far as half way along the kiln before any alteration in its composition may be detected. The thick paste acts like a solid impervious body which the gases cannot penetrate. This demonstrates the inefficiency of the ordinary rotary kiln considered as an apparatus working by heat convection, and is the cause of its low efficiency and of the high temperature of the exit gases. Conditions are much the same in a metallurgical flame furnace, and explain the high temperature of the waste gases, which carry away 30 per cent of the heat produced.

A number of improvements have been suggested with a view to improving these conditions, such as furnaces with heat-recovery boilers, air heaters, etc., but none of these devices can be deemed an ideal solution or one that really increases the efficiency of the furnace.

A Compound Flame Furnace

Another recent suggestion is suction heating, whereby the gases are drawn through the material and penetrate throughout the mass. By this system, which has been adopted in metallurgy, the gases lose the greater part of their heat content. The underlying principle of the device is as follows: If in a vertical kiln a column 10 metres high is required to lower the temperature of the combustion gases to about 150 deg. C., the same results can be obtained with a height of 25 cm. if the material to be treated is lying on a grate and if the gases pass from the upper side to the lower side, penetrating it thoroughly. With the aid of this theoretical and practical data, the author has built a compound flame furnace, of which the main characteristic is that the sole or a part of it is formed by a grate through which the combustion gases may be drawn from top to bottom.

Thus the heat process is divided into two theoretically ideal parts; melting or clinkering in the combustion zone is by radiation, and pre-heating or calcination on the grate is by convection. As the combustion gases are drawn through the grate the entry of excess air into the apparatus is impossible and the exterior radiating surface is reduced to a minimum.

Material Moved Along on Vibratory Grate

The passage along the grate of the material to be treated is carried out by oscillatory, vibratory, or similar movement of the grate. The compound flame furnace consists of a fixed suspended arch made of first-class refractory material resisting the highest possible temperatures. The sole and/or the grate, which is not submitted to the high temperatures of the medium since it is covered by the material to be treated, may be made of cinder concrete or, in the case of the grate, of steel sections.

With the smelting flame furnace is merely combined a grill on to which the material to be treated is fed as required. The combustion gases reach this part of the furnace at a temperature of 900 to 1,000 deg. C., and pass through the material to be treated from top to bottom. In the course of their passage through the material the gases lose the greater portion of their heat and cool down to about 120 deg. C., when they are then sucked off by a fan and pass into the atmosphere.

Construction of Kiln

The clinkering flame furnace, as designed for cement manufacture in combination with a grate, consists of a fixed suspended arch, which may reach considerable dimensions, made of first-class refractory material enabling extremely high temperatures to be obtained and thus improving the efficiency of the apparatus. The sole and grate, which may be made in one piece, are not exposed to the high temperatures of the surrounding medium as they are covered by the material to be treated. Part of the sole is solid and made of cinder concrete or other refractory material, whereas the remainder, forming the grate, may be built of sectional steel. An important detail is that the gas openings or slots are parallel to the furnace. Both sole and grate, whether combined or separate, are mounted on rollers and given an irregular oscillating movement by means of an elliptical reducing gear so as to cause the material to travel forward.

Controlling Movement of Material

For a cement furnace of this description, to transmit the oscillating movement to a 1 m. by 18 m. sole, a 20-hp. motor is all that is required. The elliptical speed-reduction gear providing the oscillating movement is directly driven by a direct-current motor and the rate of travel of the material is easily controllable; for instance, with a 300-mm. stroke at a speed of 42 revolutions per minute, the crushed material is turned over without moving forward, while if the speed is increased the material travels forward. The rate of travel can be accurately regulated without stopping the motor. As for the strength of the shaking mechanism, it may be mentioned that most coal mine conveyors are of the oscillating type, and potassium mines use conveyors of the same type with an output of 300 tons and a length of 120 meters. A flame furnace combined with a supplementary grate charged with bodies capable of storing heat, such as hollow cylinders or solid balls, and fed with slurry, may by continuous or intermittent pulverization be used for the preparation of cement by the wet process.

The slurry will be pulverized intermittently by the heat-retaining bodies on the drying grate. The hot gases drawn across these bodies bring them to a high temperature, and owing to their high heat capacity, which is about 2,000 times higher than that of the combustion gases, the drying process commences immediately. The vibratory movement of the grate dries and granulates the slurry, which subsequently falls on to the main calcining grate.

This arrangement may also be used in the usual type of rotary kiln for drying the raw cement slurry efficiently. It would appear that the compound flame furnace may be used with advantage for any heat treatment, such as the desiccation, calcination, distillation, pre-heating and clinkering of various products.

Men and Mills

[News of and for Cement Mill Men]

A clearing-house page for all kinds of news about cement men and cement mills. ◖ Readers in all mills, even though not regular contributors, are invited to send in news notes about personal and plant activities that may be of interest or value to the men in other mills.

While use of portland cement was still far below the average for the last five years, there was a gain of about 19 per cent in 1934 over 1933, according to E. J. Mehren, president of the *Portland Cement Association.*

Capacity of portland cement plants is estimated at nearly 250,000,000 barrels. Shipments in 1934 were 31 per cent of capacity.

Private construction, however, is facing a revival in 1935, Mr. Mehren believes, which should improve conditions in the entire construction industry. Industrial construction improved 36 per cent in 1934 over the previous year and should carry on during 1935.

New developments in concrete house construction have brought thousands of inquiries to the *Portland Cement Association.*

●

Average production per tree of the 75 acres of citrus property of the *California Portland Cement Co.* at Colton, California, has been higher than the average of the Colton district as a whole, according to Earl F. Van Luven, manager, who submitted his twentieth annual report to the company on January 21.

Prior to 1914, a number of grove owners had filed court actions contending dust from the cement plant was proving injurious. The company purchased its grove holdings and have since operated them on a commercial basis.

●

The Glencoe Lime & Cement Co., in business in St. Louis for more than fifty years, recently consented to appointment of a receiver to protect its assets, which are alleged to have been impaired by suits of former employes to collect damages in silicosis cases.

On recommendation of counsel for the plaintiff and for the company, Judge O'Malley appointed Gus H. F. Johannes as receiver.

Johannes has been president of the company for the last two years.

●

At a meeting of the *Pennsylvania-Dixie Cement Corporation,* held on January 22 at the Biltmore, New York City, Blaine S. Smith, president, told members of its metropolitan sales organization that 1934 showed improvement over 1933 for the cement industry. Commenting on the outlook for 1935, Mr. Smith saw an increase in construction during 1935, and predicted that due to government assistance toward easier and simpler methods of financing many of the 5,000,000 needed homes will be built during the year.

●

Edwin K. Borchard

Edwin K. Borchard has been appointed Technical Manager by the Keystone Portland Cement Company with offices in Philadelphia, New York and Boston. Mr. Borchard has been associated with the Universal Atlas Cement Company, as Technical Service Manager, and for many years with the Atlas Portland Cement Company and the Portland Cement Association in technical and editorial work.

●

Canada Cement Co., Montreal, should show slow improvement in business and earnings during the current year over 1934, but no sharp upturn is likely, J. D. Johnson, president, stated at annual stockholders' meeting in January.

●

Contracts for the purchase of 238,000 barrels of cement at a cost of about $500,000 for use in part of the state's $10,000,000 road program, have been awarded, it has been announced by A. P. Tugwell, chairman Louisiana highway commission.

●

Missouri Portland Cement Company, St. Louis, and Subsidiaries—For 1934: Net loss after depreciation, depletion and other charges, $19,607, compared with $355,956 loss in 1933.

Stockholders of the *Signal Mountain Portland Cement Company* will receive a 2 per cent dividend, the first in about five years, it was decided at the annual meeting of directors in January. The dividend will mean the distribution of about $50,000, John L. Senior, president of the company, estimated. Officers and directors of the company were re-elected.

●

George F. Bayle, Jr., for several years a vice president of the *Glens Falls Portland Cement Company,* was elected president at the annual meeting of the company on February 5.

●

Lawrence Portland Cement Co. shows for the year closed December 31, 1934, net income of $93,626, after depreciation and depletion, equal to $1.24 a share on 75,000 no par capital shares outstanding, against net loss of $40,930 reported in 1933.

●

The annual report of *Superior Portland Cement, Inc.,* shows that during the year the company paid twelve months' dividends on its class A stock and on December 31 there were deferred payments due on only six months' dividends.

●

Wolverine Portland Cement Company, for 1934, shows a net income after expenses, depreciation, depletion and other charges of $32,365, equal to 32 cents a share on 100,000 common shares, against $8,234, or 8 cents a share, in 1933.

●

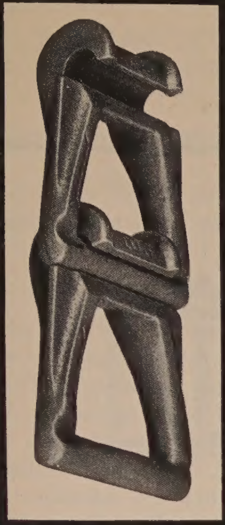
Ideal Cement Company stockholders met on January 22 and re-elected all directors for the coming year. The board consists of Charles Boettcher, Claude K. Boettcher, Robert S. Nast of Pueblo, Wilbur Newton, A. E. Humphries and R. J. Morse.

●

Wheels at the *Aetna Portland Cement Co.,* Bay City, Michigan, will begin turning earlier this spring than in past years because of last fall's early shutdown, Edward A. Harris, plant manager, announced on January 19.

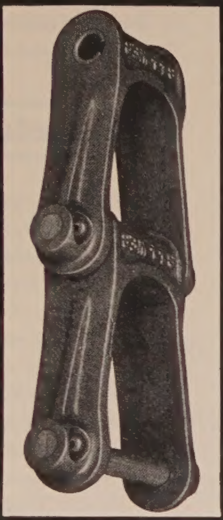
●

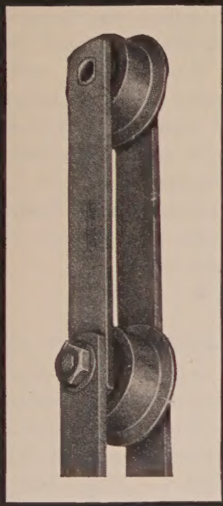
Lehigh Portland Cement Co. announced an accumulation dividend of 87½ cents a share on the 7 per cent preferred stock, payable April 1 to holders of record March 14. Effective with this distribution arrears will be $8.75 a share.



LINK-BELT CHAINS & SPROCKETS

for Drives and Conveyors fit Industry's Needs





HUGE stocks of chains made of Promal, malleable iron and steel for every conveying and power transmitting service—thousands of cut and cast tooth sprockets built to fit and work with chains of standard pitch—a complete line of conveyor and power transmission accessories of all types—carried at convenient points throughout the country by jobbers and at our plants and warehouses.

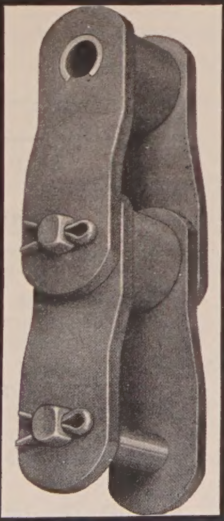
Look for the Link-Belt identifying trade >——< mark. It assures you of the highest quality that the leading chain manufacturer can produce. Send for 1024 page general catalog engineering data book No. 600, showing the complete Link-Belt line. Address nearest office.

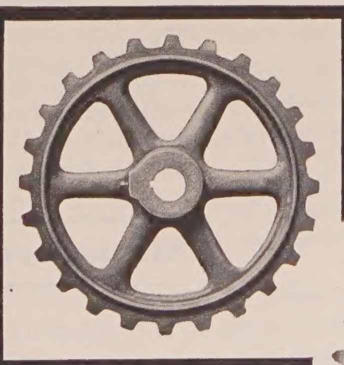
LINK-BELT COMPANY 5171-B

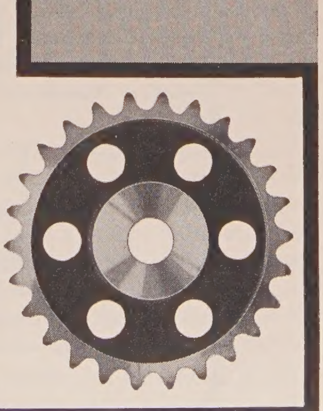
The Leading Manufacturer of Equipment for Handling Materials and Transmitting Power

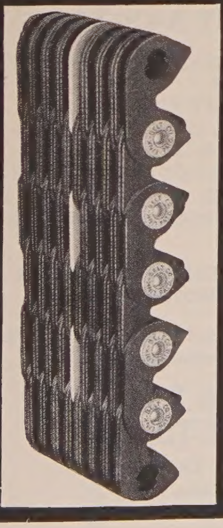
INDIANAPOLIS CHICAGO PHILADELPHIA ATLANTA SAN FRANCISCO TORONTO

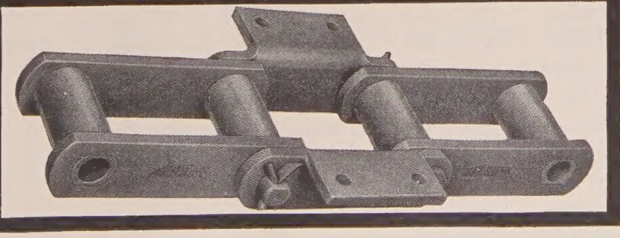
Offices in Principal Cities







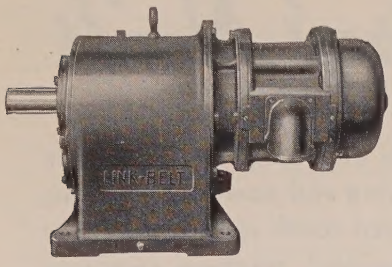




MILL EQUIPMENT

MOTORIZED Helical-Gear Reducers, in a new line, are being placed on the market by Link-Belt Company, Chicago. These reducers are self-contained enclosed speed-reducing units.

A standard round-frame motor conforming with National Electrical Manufacturers' Association specifications, is secured firmly to side of reducer housing by means of an adapter casting which supports the motor shaft in over-size anti-friction bearings close to the pinion, thus assuring good alignment and proper mesh of pinion with its mate, they say. The complete motor, with adapter and motor pinion, may be removed as a unit for inspection or maintenance, without disturbing the alignment of the motor, or of the gears remaining in the reducer housing; in fact, the motor pinion and gear are removable without disconnecting the driven machine or disturbing the low speed gears.



Link-Belt Motorized Reducer

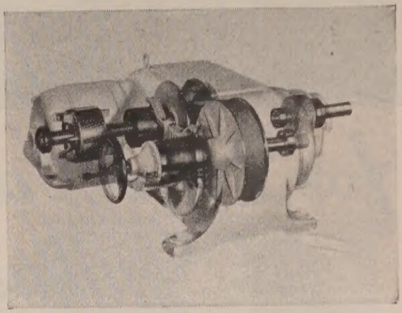
The new motorized reducers may be mounted on floor, ceiling or wall; and are available in double reduction for ½ to 75 H.P., in ratios up to 38½ to 1, and in triple reduction up to 30 H.P., in ratios up to 292 to 1.

●

A NEW lever arm construction, developed for the larger horsepower ratings of the U. S. Varidrive motor, is an improved development in variable speed, for use in the cement industry, announced by the U. S. Electrical Manufacturing Company, Chicago.

The formerly separate units consisting of a constant speed motor, a variable speed device, and a gear case have been built into one compact unit at a great saving in space, in addition to the economy effected due to the elimination of mounting bases and transmissions, such as couplings, fans, and belts between the component parts.

The phantom view shows how the speed change is obtained by the micro-speed control which varies the effective driving diameter of the Varidiscs. These discs expand and contract for higher and lower speeds transmitting power through the Varibelt to the take-off shaft. This new motor being self-contained can be conveniently direct connected to machinery. It places at the operator's command, the makers say, any variation of speed, so that the driven machine can be operated at its highest capacity at the will of the operator.



Phantom view of U. S. Varidrive motor

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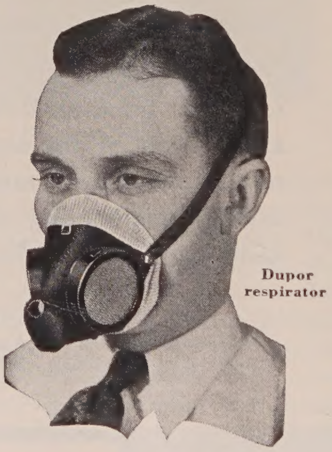

Dupor respirator

DUPOR—a new double filter chamber respirator—has been designed for use in smoke, paint spray, light fumes, vapors and all kinds of dust. It is manufactured by H. S. Cover of South Bend, Indiana.

Manufacturers' News

THE Babcock & Wilcox Company, New York City, announces a 25 per cent reduction in the price of the B & W Junior Firebrick. The new price, $90 per thousand in carload lots f.o.b. Augusta, Georgia, applies to the firebrick heretofore sold under that name. The company claims that this new reduced price extends the use of the Junior Firebrick, making its application economical in many furnaces and for conditions for which it was not formerly used because of its higher initial cost.

●

SHIPMENT of a Cottrell electrical precipitator installation has been made by the Western Precipitation Company of Los Angeles, and is now being erected for the recovery of dust from cement kilns at Companhia National de Cimento Portland at Rio de Janeiro, Brazil, a subsidiary of the International Cement Corporation.

Industrial Literature

HARDINGE bulletin No. 13-C contains: Open versus closed circuit grinding; ball mills versus pebble mills; the Hardinge conical mill; classification—wet and dry; air classifiers for dry grinding mills; counter-current classifier for wet grinding mills; chemical and industrial pulverizing methods; ore reduction and concentration; coal pulverization—storage and unit systems; the Hardinge constant weight feeder; operating data—specific and general, and capacity and dimension tables.

●

LEAFLET 2182, descriptive of the new Seal-Clad induction motor, with protected windings has been issued by Allis-Chalmers Manufacturing Co., Milwaukee. Seal-Clad Motors are built in ratings up to 25 H.P., 1800 R.P.M., furnished with either ball or sleeve bearings.

CLASSIFIED ADVERTISEMENTS

USED EQUIPMENT

CEMENT MILL
EQUIPMENT BARGAINS

2—NEW ALLIS CHALMERS 9½'x8'x40' COMPEB MILLS
2—REEVES ROTARY KILNS 8'x125'
4—TUBE MILLS—5'x22'
2—KOMINUTERS 85"x8'
1—MARION 460 ELECTRIC CATERPILLAR SHOVEL
1—MARION 480 STEAM CATERPILLAR SHOVEL

CRUSHERS, DRYERS, COMPRESSORS AND MOTORS

The above equipment at attractive prices for immediate sale

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